

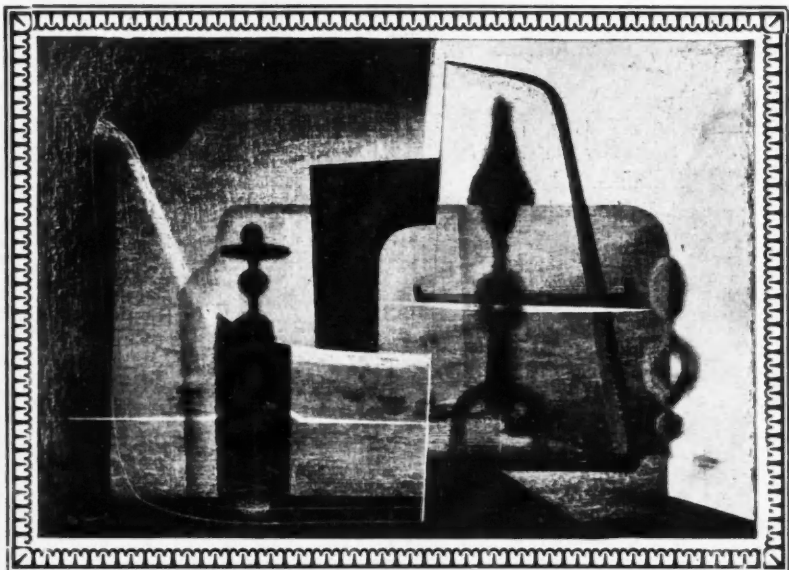
The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVIII
No. 1228

SATURDAY, JANUARY 9, 1943
REGISTERED AS A NEWSPAPER

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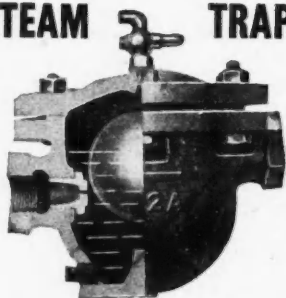
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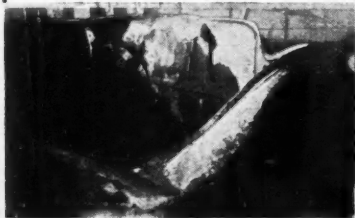
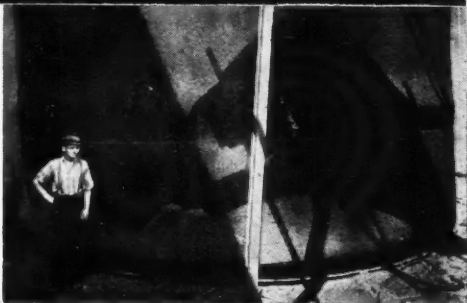
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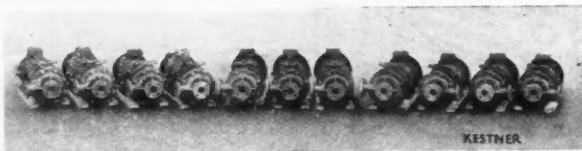
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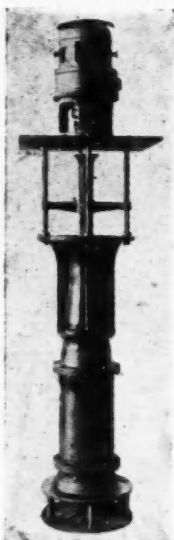
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Aspects of an Industry

THE ACID TEST

No mere colloquialism. Sulphuric acid is so widely used in Industry that it is commonly taken as an index to the state of trade. The acid is used as it is produced and therefore the chart of its consumption reflects the fluctuations of business quickly and closely. Acids, with their opposites, the alkalis, are both in volume and range of uses the most important direct contribution of the chemical industry to Production. There is scarcely a commodity, scarcely even a single article which can be made without either acids or alkalis entering at one or more stages of its manufacture. Sulphuric acid, otherwise known as oil of vitriol, is used in almost every conceivable industry. It is noteworthy that the modern method of producing the acid from iron pyrites, air and water was suggested in 1831 by Peregrine Phillips, a Bristol vinegar brewer. The other essential "heavy acids" are

nitric and hydrochloric. Tens of thousands of tons of nitric acid, once known as "aqua fortis" or "strong water," are produced by the British chemical industry every year, and more in war even than in peace, for it forms the basis of nearly all explosives, as well as of the inorganic fertilizers which are today required in increasing quantities to grow more food from British soil. Hydrochloric acid, or spirit of salt, is a combination of hydrogen with chlorine and finds wide uses in the metal pickling, tanning and textile trades. The heavy acids are in one sense the manufactured products of the chemical industry. In the much wider sense they are essential raw materials without constant and adequate supplies of which the wheels of production would stop turning. It is reassuring that the British chemical industry is the largest manufacturer of heavy acids in the world.



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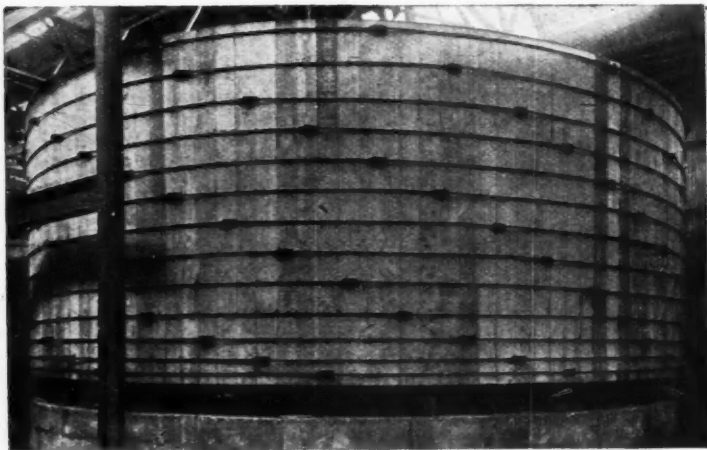
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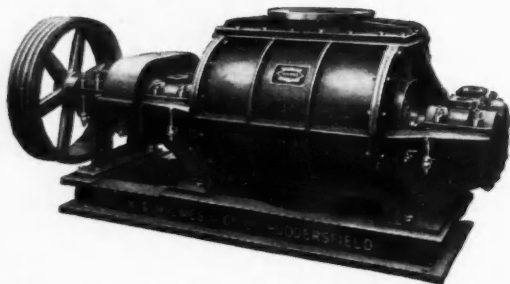
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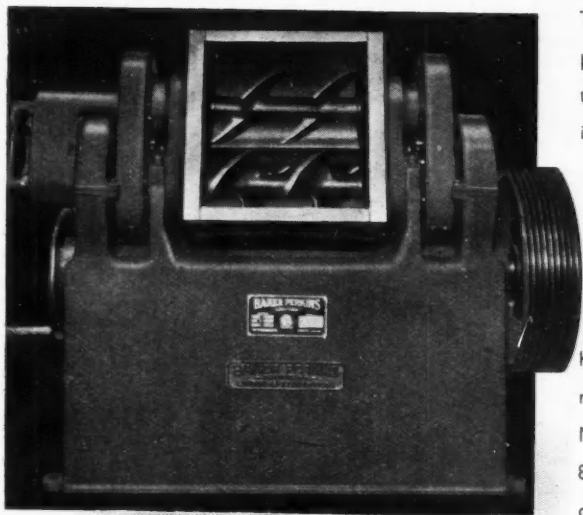


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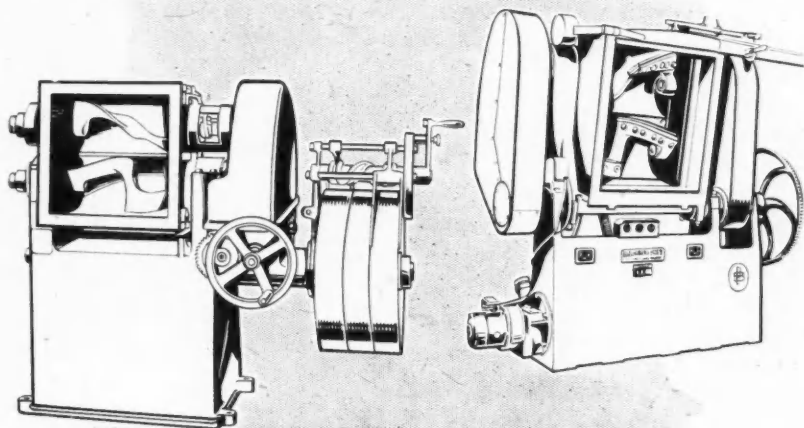
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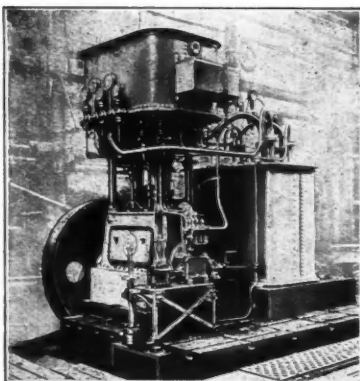
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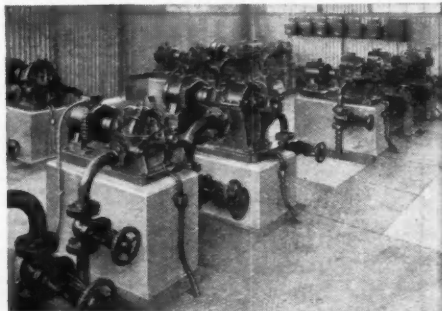


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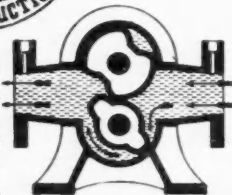
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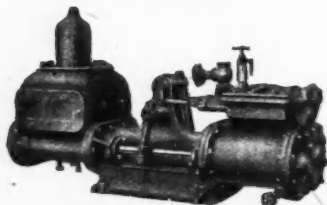
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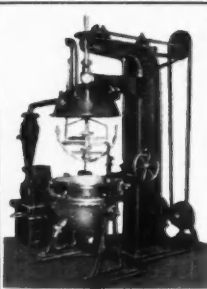
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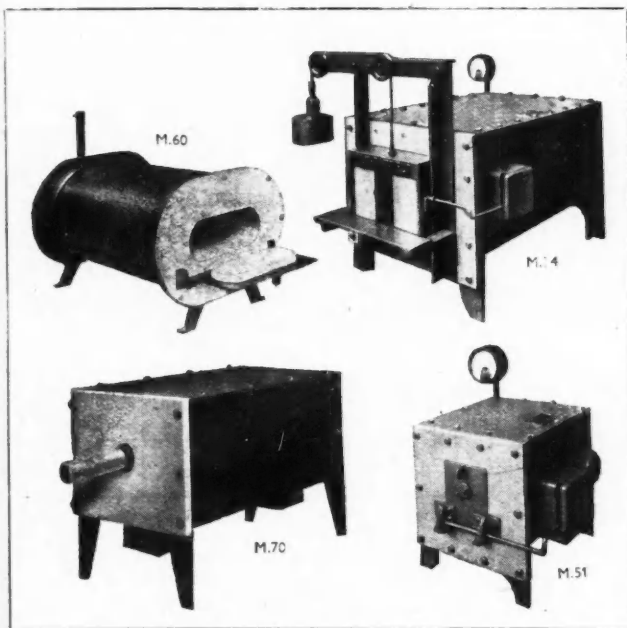
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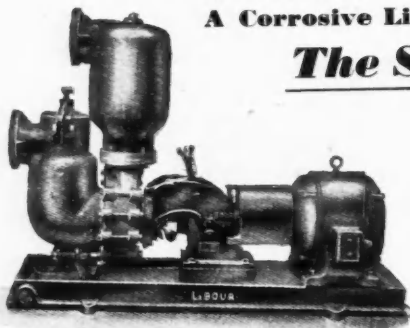
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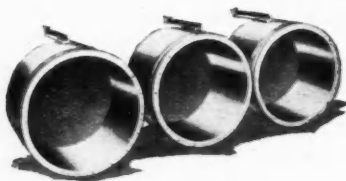
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The Chemical Industry in 1942

SOME industries are stimulated by wars and rumours of wars, others are caused to wilt. The chemical industry is among those that respond to the external stimulus, for the profession of chemistry is as necessary to the prosecution of modern warfare as is the profession of arms. The reviewer, looking around the international field of 1942 from the standpoint of 1943, finds much to marvel at, and much food for thought. It is not easy to present a picture of what has been happening during the past year. News is scarce, and reliable news scarcer still. But amid the welter of published material and through the curtain of silence imposed by the censor's pencil, certain general trends stand out prominently.

One of these is the intense effect of war upon the development of chemical industry in the widest sense of the term "chemical." If this war is to be regarded as another 30 years' war, with an uneasy truce in between, then it can be said that the whole 30 years has been a period of intense development. There is no need to recall here the new industries and products that have arisen during that period. But among the outstanding characteristics has been the

stimulus given to synthetic manufacture of natural materials or of materials that were otherwise unknown. Normally, development would be relatively slow, being impeded by the need to conform with established economic principles, or to pay the cost of not doing so in the monetary fine imposed by the commercial world upon those who try to sell a product in a market where the price is lower than the cost of production. Germany, however, has been bound by no such limitations; perhaps it is more correct to say that the German Government were content to pay the fine in order to prepare for war. As a part of the 30 years' war, therefore, there has been an intensive search in Germany (and Japan) for new synthetic methods of production so that when the war that

was in course of preparation finally broke out, there should be no shortage of raw materials. To this we owe synthetic rubber and synthetic petrol, to name two only. The effect has been to stimulate rapid development of synthetic manufacture, and to antedate by many years the time when these processes would have been commercially established.

Nor can it be doubted that the same process is proceeding apace in Allied coun-

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tries. The progress of the war has denied us access to many raw materials that were over-produced in times of peace. The result has been in the first place that plants have been built or projected for the manufacture by synthetic methods of the same substances, or of substances having similar properties. How this has been put into practice in the metal industries can be seen from THE CHEMICAL AGE for November 21. The use of new alloys has been greatly accelerated, and many alloys have been found, made with available metals, that will take the place of those that are not now available. The outstanding example in the purely chemical field is synthetic rubber. There are several methods of making a rubber substitute, and different nations may use different methods. The production of four types of synthetic rubber is to be undertaken on a large scale in the U.S.A. (Buna, Neoprene, Thiokol and polyvinyl chloride). By arrangement with the U.S.A. they, and not we, are to do this work; petroleum products which are required as raw materials are not available here. The plans were described in THE CHEMICAL AGE on March 21, but how far they are being adhered to, or extended, and what progress has been made we do not know. Canada, too, has announced plans for constructing similar plants, operating on petroleum derived from the U.S.A. One wonders whether as the result of the improvements that will almost certainly arise, rubber planting will go the way of madder cultivation.

A second result of the incentives to chemical industry arising from war has been the rapid progress of discovery and development. The war is compressing into months scientific developments that would otherwise have taken perhaps half a century. That is the view expressed recently by Dr. Charles Stine, adviser on research to the Du Pont Company. The inevitable result will be that "industry will emerge from the war with the capacity for making scores of chemicals and other raw materials on a scale that only two years ago was beyond comprehension." We are sorry, though our sorrow savours of the empty conventional phrase, for those who would put back the clock and bid science take a holiday. The facts are against them. Science has shown how rapidly it can accelerate, and

those who do not jump with the times will be run over. Science, like the internal-combustion engine, is dividing mankind into the quick and the dead.

It will not be out of place to follow Dr. Stine a little farther in his survey of the technical progress of the past year or two. The beginning of this century saw a revolution in transport; that revolution is in process of being extended by the new alloys, fuels, and plastics that are available. "Measured by the old pace of development, we are now in the 1960's of motor cars; weights in future may be half what they are now, power will be increased, and fuel may yield 30 miles per gallon." In housing there will be available in profusion, plastics, rustless steels, non-ferrous alloys, and other materials not previously used to any extent. In this country we even persuade architects to utilise the modern technique of fuel technology to make our houses comfortable and fuel-savers instead of fuel-wasters! Dr. Stine believes stainless steel will be used as a roofing material. We shall have, he says, glass that is unbreakable and glass that will float; wood that will not burn and laminations of wood and plastics that will compete with structural metals. The pre-war wonder of hosiery derived from air, water and coal is likely to be the forerunner of many innovations of the same type ranging from shoes that contain no leather to window screens that contain no wire, and machinery bearings that contain no metal. The manufacture of synthetic rubber, aluminium, magnesium and many other products will be on a scale many times as great as before the war.

In general, therefore, Dr. Stine foresees an age when new materials will take the place of old materials manufactured by chemical processes. There will arise the need for far-reaching adjustments in older and established industries. One industry will clearly vie with another in keeping ahead in the technical progress race. It will be a difficult time, a time in which the scientifically and technically ill-equipped will go to the wall; for the race cannot be stopped without disaster to those who first cry halt. The cry that science shall take a holiday was never very convincing; it has been put quite beyond the bounds of possibility by the 30 years war of our time. The commercial developments indicated by Dr. Stine will be to the advantage of the

world in the long run; in the immediate future, however, will they not complicate immensely the work of reconstructing our business system on a sound footing by removing the factor of stability from many old-established industries?

A third effect of the war has been to encourage the wider spread of manufacturing processes. China has been forced to start new factories and new enterprises to provide arms to repel the invader; the technical skill thereby obtained will not be forgotten. Here are a few statements that have been published during the year in illustration of this trend. Great new plants for synthetic phenol manufacture have been erected in the U.S.A. U.S.A. defence needs for T.N.T. are being supplied for the most part from toluene made by the petroleum industry, in plants already operating or come into production in 1942. In Mexico a new CS_2 plant meeting all market requirements for this material came into production; also an electrolytic soda plant in that country was started with a capacity of 3 tons NaOH daily, and making potassium chlorate and calcium arsenate as by-products. In South Africa, "energetic efforts" have been made for the production of chemicals needed by the Union's staple industries from local raw materials; these included barytes, bichromates, sodium chloride, mercury, and zinc sulphate; molasses is there being used for the production of alcohol; a sodium silicate factory is now in operation at Johannesburg and another at Durban; tung oil is the basis for a new industry in the Union, and there seems a good possibility that a synthetic petrol plant may be established there. Formaldehyde is now made in Ireland. In Peru a great iron and steel works with a hydro-electric scheme is under construction. Throughout Europe Germany is establishing, or allowing to be established, new industries of a chemical character to supply her war needs. The same tale could be told of many countries, as may be seen by those who have the curiosity to look through the files of *THE CHEMICAL AGE* for the year. What will be the outcome of this? It will mean, surely, that countries like Great Britain, which in the past have relied upon exports to balance their budget and to pay for imports, will find their market restricted at a time when economics will

demand expansion. Yet our reformers go gaily ahead planning great social betterment schemes, irrespective of the difficulties of the international situation that will confront us after the war.

Many sign-posts that stand out from the events of 1942 might be indicated, but attention is here directed to only one other. This fourth effect of the war is the energy with which man is searching the surface of the globe for raw materials. And not only the surface of the globe; his search extends to the heavens above, the earth beneath, and the waters under the earth. Nor is he content with searching and mapping. When discovered, plans are being feverishly made and machinery erected to develop these new sources of raw materials for war purposes. Thus we read of magnesium, iodine, and potash from sea-water; bauxite, potash, zinc, manganese, and many another source of metals or salts from many parts of the world. Helium, too, is to be produced in greatly expanded quantities from petroleum wells in the U.S.A. to meet war needs. So the tale goes on. After the war the world will be faced with a glut of raw materials which it will tax our brains to utilise. The resources of the earth are being used at a rate as never before, and this spate of discovery of new raw materials must needs have the effect of causing serious wastage if the nations as a body do not put a check on production and insist upon avoidance of waste in mining and working up. That surely, will be one of our primary tasks in reconstruction. The Atlantic Charter laid down the principle that all nations should have equal access to raw materials; something wider still than control of distribution is needed.

Important as these developments abroad are for the future of British industry, the requirements of war-time secrecy have prevented us from saying anything of what has been done in this country. When the tale can be told, we shall not be found wanting in setting the pace of chemical development. Our record in new ideas, new discoveries, and new plant developments is fit to be compared with those of any other nation. Our sword, the sword of research, must not be returned to its scabbard and allowed to rust when the conflict is over.

A New Year Message

from the President of the Institute of Chemistry

IN surveying the position and activities of chemists in relation to other scientists, we see that we have an important place in the war effort, whatever the nature of our immediate activities. No reader of *THE CHEMICAL AGE* will need any reminder of the general scope of our duties. While it is impossible for many of us to devote as much attention as in the past to the interests of chemistry in those branches of the science to which we happen to be more particularly attached, still we may, even now, profitably consider how we can bring about closer collaboration. This is not the place to set out the reasons for the necessity for such collaboration.

While this is generally accepted, it is being urged in much too general terms. In the long run the success of any scheme will be judged by its effect on chemistry generally and what it does for the community. The first step has been taken in the scheme of co-operation by the three chartered chemical organisations. The past years have been fraught with far too serious events to permit relaxation of our immediate tasks. Nevertheless, as we are



Dr. J. J. Fox.

now moving on, it is not inappropriate to turn our attentions for awhile to the future position of those who are likely to continue in the practice of chemistry. It may be expected confidently that the great majority of those now engaged as chemists in national work will be occupied in their profession in peace-time, either by returning to their former posts or by taking up new work. It is of the utmost importance that the position of the partially trained chemist now engaged in such numbers in important work within or without the Forces should be kept in the forefront in any schemes of reconstruction. It will not be

sufficient to complete the training of these people without making provision for their useful employment and encouraging the best to devote themselves to chemistry in some of its newer aspects, whether academic or industrial. It is this feature of chemistry and chemists which I stress. Chemists must be prepared to act vigorously so that the outcome is not left to be decided wholly by non-scientific personnel.

J.J.F.

Research in Industry

Survey by New F.B.I. Committee

THE committee which the F.B.I. has set up (under the chairmanship of Sir William Larke) to consider the question of industrial research, has reached certain preliminary decisions with regard to its programme of work. The primary task of the committee is to stimulate the utmost possible interest in industrial research. It is proposed to make a survey of present industrial research activities and to obtain an indication of the results already achieved in many spheres of British industry. The necessary information from which the survey can be compiled is being sought from various sources, including industrial research asso-

ciations, commercial associations, and individual firms, the assistance of which is earnestly requested. The restoration of export trade will be an immediate post-war necessity, and this and our domestic needs will be dependent upon industry's productive and competitive power. This, in turn, must be largely dependent upon technical advance and research. The committee hope that their work will not only point the way, but provide a stimulus to all concerned to harness the great body of scientific ability and experience, which this country possesses and has organised with such success in the war effort, for the work of industrial development and reconstruction in the post-war period.

The names of the committee will be found on p 74 of this issue.

THE CHEMICAL INDUSTRY AND THE WAR

by

P. PARRISH, F.I.C., M.I.Chem.E. M.I.Gas E.,
F.I.I.A.



Mr. P.
Parrish.

THIS is the fourth review since the world war began. There is more reason for confidence this year than twelve months ago. We are now on the attack, but we have not seen the worst, nor indeed are we in sight of the end, despite the recent encouraging portents. The nation cannot afford to relax: indeed, it must organise itself as never before, if victory is to be achieved. There will be still further calls on our man and woman power: more difficult problems to solve, and unless we mechanise—probably in an improvised way—many manual operations, the nation will be hard put to it to maintain, with satisfaction, the exacting demands for increased production which will necessarily be made.

1917 and 1942—A Contrast

The situation, to-day, possesses elements not dissimilar to those described by the Prime Minister¹ when he became head of the Ministry of Munitions in July, 1917, after about three years of the Great War. To establish a true contrast with the present time, it will be apposite to quote at some length:—

"... Three years of the struggle had engaged very nearly the whole might of the nation. Munition production of every kind was already upon a gigantic scale. The whole island was an arsenal. . . . The former trickles and streamlets of war supplies now flowed in rivers, rising continuously. The principal limiting factors to munition production . . . were shipping (tonnage), steel, skilled labour, and dollars. The last of these had been rendered less acute by the accession of the United States to the Allies. . . . The stringency in shipping was acute. The losses of the U-boat war, the requirements of the armies in every theatre, the food and what remained of the trade of Britain, the needs of the Allies . . . had drawn out our mercantile marine to its utmost intense strain. Tonnage therefore was, at the period, the controlling

factor in our production. Steel ranked next to tonnage and was a more direct measure of the war effort. The steel output of Great Britain had already nearly doubled. Mines which would not pay had come into active production.

I found a staff of twelve thousand officials organised in not less than fifty principal departments. . . . I set to work to divide and distribute this dangerous concentration of power. Under a new system, the fifty departments of the Ministry were grouped into ten large units, each in charge of a head, who was directly responsible to the Ministry. These ten heads of groups of departments were then themselves formed into a council, like a cabinet. . . . The big business men who now formed the Council were assisted by a strong cadre of civil servants. Thus, we had at once the initiative, drive, force and practical experience of the open competitive world, coupled with the high standard of experience, of official routine and of method, which are the qualifications of the Civil Service. The relief was instantaneous."

One need not stress the similarity to present-day position. Apart from the interest which the administrative rearrangement evokes (and which must be of paramount interest to-day), it is known that we must have more steel and more coal: and we must arrest the sinking of ships by the U-boats. Equally, skilled labour is in acutely short supply. While many chemical products are now being manufactured at almost an optimum rate, the war on two, or three, or more fronts may tax present productive capacity in certain directions, and military requirements will doubtless invoke greater

production, and perhaps necessitate more constructions.

Last year's attack on Pearl Harbour, with the consequent loss of British Malaya and the Dutch East Indies, deprived the Allies of large quantities of natural rubber. The United States, in normal times, used 600,000 tons of natural rubber in a year, but this quantity increased by 30 per cent. in 1941. From no other region than British Malaya and the Dutch East Indies can one get more than a small fraction of the United States and British requirements. Fortunately, Russia has an enormous synthetic rubber industry; they are, without doubt, the largest producers in the world. The United States and this country are now reclaiming rubber, which represents the greatest emergency source, and large plants are being built for the production of synthetic rubber. It is estimated that a £100,000,000 of capital is required to erect plant to produce 400,000 tons of synthetic rubber per year. Such a programme has been decided upon in the United States, and eighteen months are likely to be required to construct economic units of such plant to yield the production indicated.

British Output and American Achievement

The 1941 war production of the United Nations exclusive of the United States, equalled the total 1941 war output of Germany,² with all its captive plants and enslaved labour. Since Germany's 1941 operations were of maximum capacity, little further increase seems possible. British output has been expanding to the point where its 1942 production is considerably ahead of Germany's. In May, 1942, American war production passed the British output fifty days ahead of schedule. In 1943 it will be three times that of the British.

In the next twelve months more magnesium and aluminium will be required, and the production of chlorine is assuming an increasingly important rôle. Electric power supply is becoming a critical factor, and interest in non-electrolytic processes for chlorine is being revealed. It is necessary to remind readers that the sea-water magnesium process now being operated is not a producer of by-product chlorine, but actually a consumer. It is known that brine is being electrolysed primarily to produce chlorine, and

that the resultant weak caustic soda may be discarded. Hence the interest in the manufacture of chlorine and salt cake with sulphur trioxide. Whether this process, either in this country or in the United States, has passed beyond the laboratory stage cannot yet be affirmed. Yet another proposal under consideration is the catalytic oxidation of hydrochloric acid made from salt and sulphuric acid.

Farmers have been requested to increase acreage, so as to ensure greater food production. This may involve a greater output of sulphuric acid, dependent on whether phosphates are forthcoming in full quantity. Supplies have not been too profuse recently, although hopes are entertained that our occupation of North Africa, and the increasing control of the Mediterranean now exercised by the British Navy, will result in supplies of Moroccan and Tunisian phosphates reaching this country very shortly, rather than Germany and Italy.

In this country, several synthetic ammonia plants have been erected since the war, and the British nation should have adequate capacity for the production of synthetic ammonia and nitric acid—a vital requirement for explosives purposes.

In past reviews mention has been made of the consolidation of German power in occupied European countries, and one has wondered how much stronger and more firmly-entrenched this Nazi instrument of warfare would become. Again this year reference is made to this aspect, but in this connection we must not overlook the efforts of our American and Russian Allies. About the former we have already spoken.

Russian Chemical Effort

Let us pause for one moment at this point to examine the prodigious effort of Russia. It has just been announced that Russia has completed a blast furnace at the famous Magnitogorsk Iron Combine in the Urals, which is reported to be the most powerful single plant of its kind in Europe. The order to build was given by the Soviet Defence Committee in the summer, when the Nazis' advance had brought the iron and steel industries on the Don, Donetz, and Azov Sea into the danger zone. The construction was effected within five months, and in the first week of December the new blast furnace was already working. Another giant construction is to be completed within the next few weeks, bring-

ing the number of Magnitogorsk furnaces up to six. Effort on similar lines is being made in coal-mining. It is understood that a hundred new mines have been sunk recently.

The mining of coal, and the activity in iron and steel production, imply the provision of coke-oven plants, either inside the pit or on the surface; the various product plants, manufacturing benzol, toluol, phenol (for plastics and for picric acid, which is being used by the Russian military on a large scale; indeed, important supplies have been shipped from the United States for twelve months now), naphthalene, special tar, carbon bisulphide, aniline from the nitration of benzene and the reduction of the nitrobenzene. Indeed, the whole gamut of chemical products—explosives, plastics, synthetic rubber, pharmaceutical preparations, and mineral acids (sulphuric, nitric and hydrochloric), is covered by a development of this kind.

To afford some indication of the constructive effort of the Soviet in the matter of blast furnaces, a table is given below, indicating the height and diameter of blast furnaces, the output of iron per day, the coke required per day, the observed time the materials are in the furnace, and the slag produced per day, in relation to the various qualities of iron made, namely, hæmatite, basic, foundry and acid Bessemer. When these figures are contemplated in connection with the Russian effort, one can only exclaim with Dominic Sampson, "Prodigious!"

One can now turn from the general to the particular, or from the brighter colours of the canvas to the more subdued tones.

In view of the importance which

plastics are assuming at the present time, it may be of interest to reproduce a table published by the United States Tariff Commission* (see page 38).

Plastics

Of the six plastic materials indicated, at least one concerns the synthetic ammonia industry: some concern the tar-distilling industry and others are not unconnected with the gas and coking industry. There are, of course, other plastics than those represented; *e.g.*, synthetic rubber may rightly be regarded as one.

The basic raw materials for the manufacture of plastics exist widely and it is hardly likely that their production will be confined to any one country, although that country which develops its synthetic and organic chemistry technique to the greatest perfection will doubtless possess an advantage. The definition of a plastic material is one which, under the influence of heat and pressure, becomes soft and plastic, and which, during this state, can either be given a predetermined form in a mould, or can be extruded through a die to yield rods, tubes, etc. Vegetable products may play a minor part in the production of plastics. Mention should be made of soya-bean plastics and casein plastics: but soya-bean plastics are not used alone; invariably they are combined with another and established kind of plastic material.

All plastic materials are either thermo-setting or thermo-plastic. Thermo-setting plastics, when once formed by heat become permanently hard and infusible: thermo-plastics can be formed and reformed by repeated application of heat. Cellulose and acetylene derivatives are thermo-plastic. Phenolic, urea, and alkylid plastics are thermo-setting. Casein

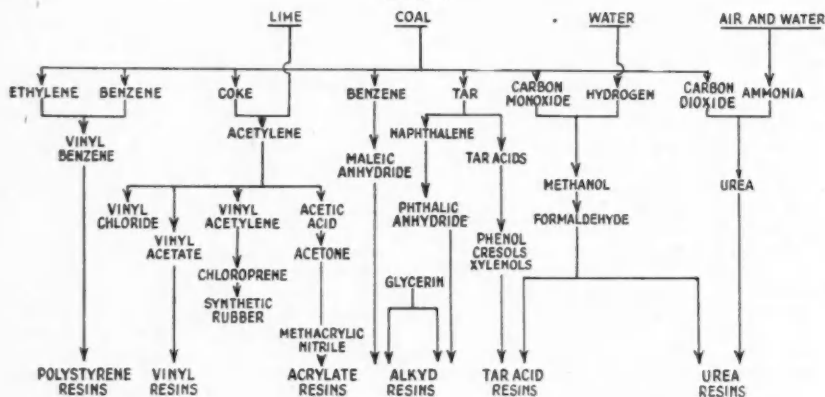
TABLE I.
EXAMPLES OF BLAST FURNACE OPERATION IN VARIOUS PARTS OF THE WORLD.
OPERATING DATA.

Technical Details.	ENGLAND. Carnforth Hæmatite Iron Co. (1915), Ltd.	GERMANY. Bochumer Verein für Bergbau und Gusstahl- fabrikation.	U.S.A. Woodward Iron Co., Alabama.	JAPAN. The Imperial Steel Works, Yawata.
Height of furnace from tuyeres to stockline: ft.	63' 6"	64' 3"	67' 2"	61' 3"
Diameter of hearth: ft.	13' 0"	12' 9"	17' 6"	15' 5"
Output of furnace: tons of iron per day	215	640	500	270
Analysis of iron—				
Carbon	4%	3.97%	3.83%	3.98%
Silicon	1.5 to 3.5%	0.58%	1.90%	1.57%
Phosphorus	Up to 0.035%	0.128%	—	0.098%
Sulphur	Up to 0.035%	0.035%	0.035%	0.04%
Manganese	Up to 1.5%	2.96%	0.25%	1.13%
Iron content of burden, excluding coke	45%	49%	37%	39%
Weight of coke charged per ton of iron made: lb.	2,576	1,760	2,640	2,318
Weight of slag per ton of iron made: lb.	1,120—1,680	1,235	2,700	1,482
Quality of iron made	Hæmatite	Basic	Foundry	Acid Bessemer
Observed time materials are in furnace: hrs.	18—20	10	12	12—15

is usually regarded as a thermo-plastic, subject to certain reservations. The thermo-setting plastics are used for

plastics will play in the post-war world. Important chemical and rubber companies have interested themselves finan-

TABLE 2



direct mouldings and for the preparation of a moulding powder, the resins, or resinoids, as they are often called, being pulverised for this purpose. One then adds to the powder a major ingredient—a filler—and the powder and filler are intimately mixed. Fillers have an important bearing upon the specific industrial application of the plastic material to be manufactured. Wood-flour meets the average industrial requirement, but fibre fillers of various kinds add insulating properties; china clay affords special hardness; ground mica is of value for electrical equipment; and asbestos is employed where resistance to heat is a primary concern.

Much has been said about the part that

cially in this development, and it is certain that an impetus has been given to research. A judicious scheme of afforestation seems eminently desirable, if this country is to occupy an important position in this industry, because for certain plastics, supplies of cellulose will play an important rôle. Transparent plastics will be increasingly used in future, and "Nylon" and "Vinyon"—two further plastics—will doubtless become of growing importance in the near future. Nylon is a derivative of coal tar and water, and will be a product of the textile industry. Shortly we may witness an all-plastic motor-car as a common feature on our roads. Table 3 shows the importance of plastics in the U.S.A.

TABLE 3.
SYNTHETIC RESINS: UNITED STATES PRODUCTION AND SALES IN 1940.
(Source: U.S. Tariff Commission).

Resin (A) COAL-TAR	Production Pounds	Sales		
		Quantity Pounds	Value	Unit value
Alkyd:				
Maleic anhydride	6,476,883	5,418,875	\$1,008,835	\$0.19
Phthalic anhydride	91,446,195	42,400,005	7,774,730	.18
Coumarone and indene	24,131,733	22,976,705	1,576,907	.07
Tar acids:				
Cresols or cresylic acid	11,978,763	—	—	—
Phenol				
For casting	6,953,103	6,696,008	3,175,589	.47
For moulding	26,417,693	25,117,472	7,869,678	.31
For other uses	26,957,636	24,234,563	4,822,729	.20
Phenols and cresols	21,126,005	—	—	—
Total coal-tar resins	222,953,118	153,520,805	33,378,406	.22
(B) NON-COAL-TAR				
Urea	21,491,653	19,300,685	7,445,483	.39
Total non-coal-tar resins	53,871,245	47,578,845	25,989,933	.55

In 1941 the Barrett Co. and the United Gas Improvement Co. began producing styrene monomer, recovered from light oils from the distillation of tar, and Dow and Monsanto increased their plant for the production of styrene and polystyrene. Moreover, the Catalin Corporation entered this field, having recently completed the erection of a new plant. The prices of polystyrene resins in 1940 ranged between 45 and 60 cents per lb. It is understood that certain grades were available at 36 cents per lb. It is reported that the Catalin Corporation purchased the land, building and equipment of the U.S. Tar Products, Inc., at Matawan, N.J., for the production of raw materials for use in manufacturing liquid resins.

Iron ore is being used in the same way as wood flour as a filler to give strength to plastic bearings. The iron ore is made into spongy iron, which is saturated with plastic. The material is moulded into bearings, which are claimed to have the advantage that the skeleton of iron strengthens the bearings and dissipates the heat rapidly.⁶

Synthetic Rubber

Many inquiries have reached the author about synthetic rubber, which may be regarded as a plastic. It is deemed prudent, therefore, at this juncture to give an epitome of the several types of synthetic rubber and their raw materials. Synthetic rubber⁷ may be divided into five groups: (1) reaction product of aliphatic dihalides (Thiokol); (2) polymers of chloroprene (Neoprene); (3) copolymers of butadiene with other polymerisable compounds (Perbunan, Buna S, Ameripols, Hycars, Chemigum); (4) plasticised polymers of vinyl chloride (Koroseal); and (5) polymers of isobutylene (Vistanex).

Most of the plants erected this year, particularly in the United States, are for the production of the Buna types. Buna S is made from butadiene and styrene. The former can be most readily produced in large quantities by the dehydrogenation of butane, available in large quantities at oil wells, or by high-temperature cracking of various petroleum fractions. An essential step in either process is the purification of the butadiene. Styrene may be made by catalytic reaction of ethylene or ethylene chloride and benzene, to form ethyl-benzene, which is de-

hydrogenated under heat and pressure, yielding styrene. Cracking of petroleum under certain conditions yields a mixture of styrene, olefines, etc., which are then separated. It is also recovered from light oil from the manufacture of carburetted water gas. The rubber is produced by emulsifying it and certain ingredients in water, under conditions of temperature and pressure suitable for converting it into a suspension of synthetic rubber, resembling latex from the rubber tree. The polymerisation proceeds rapidly: the process requires careful control, but there are no problems that differ greatly from those ordinarily met in everyday operations. The rubber is recovered by coagulating the emulsion with acetic acid.

Buna N is manufactured from the raw materials butadiene and acrylonitrile. The latter may be made by at least two methods: (i) dehydration of ethylene chlorhydrin, which in turn is produced by the reaction of ethylene chlorhydrin and sodium cyanide. Ethylene chlorhydrin is made from ethylene and chlorine. (ii) Direct addition of hydrogen cyanide to acetylene by means of a catalyst. The butadiene and acrylonitrile are emulsified in water, using soap as the agent. By combining the proper conditions of temperature and pressure, a whitish, viscous suspension of Buna in water is first formed. An acid coagulant is added, and the curd separated and dried. It resembles pale crepe.

Nazi Chemical Activities

It is interesting to examine what has occurred in Eastern occupied areas, as a result of German occupation. The Polish state-owned plants, *e.g.*, Moscice-Chorzow and Panswowa nitrogen units were incorporated in the huge Hermann Goering concern. In Russian occupied territories transfers were effected in a relatively easy way because of State ownership. The I.G. Farbenindustrie has, it is understood, purchased the Boruta Chemical Industry Company at Lodz; it has been renamed Teerfarbenwerke G.m.b.H., and the plant is being modernised and expanded to produce textile chemicals, in addition to dyestuffs.

Two types of company, one a trust company, the other an operating company, are emerging not only for Poland, but for other eastern territories. In the latter, the Baltische Oel A.-G., Ost Oel

G.m.b.H., Berg and Huttenwerks Ges. Ost m.b.H., and Ostfaser G.m.b.H. have been established to exploit the indigenous resources of shale oil, mineral oil, minerals and fibres. Other new companies are the Soda und Aetzalkalien Ost Ges., Chemie-Ost Ges., Stickstoff Ost Ges. Superfosfat Ost Ges. and Seifen und Waschmittel Ost Ges. The purpose of the latter companies is apparently to supervise factories, labour, and raw materials for soda and caustic alkalis, chemicals, nitrogenous compounds, superphosphate, and soap and washing-agent industries.

In occupied territories, as well as in the Reich, a machinery and plant census has been taken. It is felt that the Reich's production problems are growing, that the length of the war is making itself felt in depreciation of machinery and plant, and breakdowns, it is understood, are not infrequent. Enough spare parts are not available, because it was predicted that the war would have terminated before this. Hitler created a Scientific Research Council in June last, designed to utilise all available resources, and particularly to direct these to the service of the state. It is understood that "pure" research is taboo, and that German scientists must devote themselves to problems directly concerned with the war effort.

Lubricating Oil Troubles

To restore the deficiency of lubricating oils, experiments have been conducted with anthracene oils, without success. High tar acids and sulphur have proved a disadvantage. Repeated distillation of shale oil, and treatment with sulphuric acid and further fractionation are said to have produced a fairly satisfactory lubricant. The Germans are collecting grape-seed residues from wine-making, and these are to be used in substitution for linseed oil. The first oil pressed from grape seeds is converted into edible oils, and the second oil is processed and used in the soap and paint industry. It is hoped to produce some 60,000 tons per annum of oil from the above source, although it is recognised that much has yet to be done in organising collection of the grape seeds.

Barium nitrophthalate is now used in Germany as a paint to protect ironwork against rust. It is claimed that its covering power can be increased by the addition of suitable dyes and pigments. Primary coats for iron and steel, to dis-

place lead pigments, are prepared from a finely-ground alloy constituted of 87 per cent. aluminium and 13 per cent. silicon. This is said to be suitable for all purposes, and to possess satisfactory adhesive and elastic qualities, even when synthetic resin binders are used.

With a view to extending and improving the process for the production of magnesium, a joint subsidiary of the I.G. and the Deutsche Magnesit A.-G. has been established. Investigations are being undertaken with Austrian magnesite deposits. A large new company, Süd-Ost Magnesit G.m.b.H., has recently been formed by leading German and Austrian producers. Measures are being taken to safeguard workers against chemical gas gangrene caused by magnesium and some of its alloys. Magnesium particles, instead of germs, reach the wounds and produce a unique gaseous condition, if such wounds and cuts are not completely cleaned. There were apparently 5000 cases of this type treated in the German industries in 1939.

Sodium cellulose glycolate is being used increasingly in the Reich as a substitute for gum arabic, agar agar and tragacanth.

Aluminium and Magnesium

Magnesium.—In the last two reviews the production of these important metals was dealt with at length. Magnesium¹ is about 60 per cent. of the weight of aluminium and about one-fifth the weight of steel. It is reported that the selling price in 1915 was about £1 per lb., and the metal remained for many years a structural curiosity. To-day, measured by cubic feet, magnesium at 1s. per lb. is cheaper than aluminium selling at 7½d. per lb. It is understood that almost half a ton of magnesium is being introduced into every American fighting plane that is built. Reference has already been made to the source of most of the magnesium now employed industrially. For the first time in the history of the world an important structural metal is being obtained from the sea, by a chemical process. In America huge pumps force 300 million gallons of sea water daily through intricate apparatus. At present magnesium and bromine are the only products recovered, but potentially, sea water contains traces of every element found on land. The difficulties attending the processes under review may be

appreciated when it is recalled that sea water contains about only 0.01 lb., of magnesium per gallon, and that the particle size of the magnesium hydroxide precipitated is less than one micron. The process of at least one company is based on the precipitation of magnesium hydrate from sea water, using lime as the precipitating agent. The hydrate is then converted to magnesium basic carbonate, and from this the metallic magnesium is produced.

The Pidgeon Process

Reference was made last year to the Hansgirk process. During 1942 an important new process has been developed by Dr. L. M. Pidgeon, of the Canadian National Research Council, for the preparation of magnesium from dolomite by ferrosilicon reduction. This new method of manufacture has gained immediate prominence: indeed, it is considered by leading American metallurgists to be the safest and most efficient method known for the thermal reduction of magnesium oxide. Important new plants are under construction in Canada and the U.S.A., and it is also reported that the plant at Permanente, Cal.,¹⁰ originally designed to operate by the carbo-thermal process of Hansgirk, and which has been the scene of a number of explosions, is to be converted to the Pidgeon process. The process depends on the simple reaction between the magnesium oxide and the silicon of the ferrosilicon: $2\text{MgO} + \text{Si} = 2\text{Mg} + \text{SiO}_2$.

The reaction proceeds smoothly at practicable temperatures under reduced pressure, in the presence of calcium oxide. Metallic magnesium distils readily at the reaction temperature and condenses in exceptional purity as a crystalline lining in a condenser tube connected with the reaction vessel. The silica resulting from the reduction combines with the lime to form infusible dicalcium silicate, which can be removed from the retort at the end of the run without slagging. Theoretically, each pound of magnesium produced requires approximately one pound of ferrosilicon containing 75 per cent. Si. Dead-burnt dolomite is used, and this is briquetted with the ferrosilicon and lime, and heated to 1150°C . under vacuum in an alloy steel retort. The retort is constructed with an integral condenser, into which a removable steel lining is fitted. The complete cycle occurs

approximately six hours, at the end of which time the condenser lining is removed, with its accumulated magnesium. Differential contraction of the steel and magnesium lining renders removal of the metal an easy task, and the magnesium "pipe" requires no further treatment or purification.

Among the many advantages claimed for the process, simplicity, rapid operation, and the low cost at which units can be erected, are clearly of paramount importance in the present emergency. Furthermore, dolomite is plentiful, and can be calcined easily in standard lime-kiln equipment, while ferrosilicon is produced on a huge scale in North America in standard electric furnace equipment from easily obtainable raw materials.

Aluminium

Aluminium.—An important new process for the production of alumina from clays has recently been developed in the United States. It is known as the Kalunite process, and although it has been devised chiefly for the treatment of the large deposits of alunite which occur in Utah, it is suitable for the treatment of any aluminium mineral which can readily be converted into potash alum. It is claimed to be a development as vital to the aluminium industry as the Bayer method for converting bauxite into aluminium. A plant is being erected to produce 50 tons of metal per day, and details of the operation of this plant will be awaited with interest. The process involves pumping a strong alum solution through a continuous autoclave at a pressure of 250 lb./sq. in., and separating the basic aluminium potassium sulphate thus formed in a thickener. Calcination in a multiple-hearth furnace is the next step, whereby part of the combined SO_3 is disengaged, leaving a mechanical equimolecular mixture of alumina and potassium sulphate, from which the latter is removed by leaching. The operating costs are said¹¹ to be high, compared with the Bayer method, but the value of the potassium sulphate and other by-products should more than offset this difference.

Another method¹² of producing alumina from alunite is (a) to calcine for approximately $4\frac{1}{2}$ hours at $450\text{--}700^\circ\text{C}$., (b) to digest the calcine with sulphuric acid, (c) to filter off insoluble matter, (d) to spray-dry the solution at $180\text{--}220^\circ\text{C}$., and (e)

to roast the residue for 3 to 4 hours at 980°C . in a rotary kiln. The product from these operations is a mixture of potassium sulphate and alumina, and its subsequent treatment is similar to that used in the Kalunite process.

Several patents have appeared, dealing with the production of alumina from low-grade bauxite. Thus¹⁸ it is proposed to reduce the ore electrothermally with coke to produce an Si-Fe-Al alloy. This, when ground and digested with caustic soda, yields a solution of NaAlO_2 and an Si-Fe residue. Alumina may then be recovered by treatment with CO_2 , and the caustic soda regenerated by heating the filtrate with lime.

Sulphuric Acid

Economy in the use of lead has been

two aspects that call for care in design. (1) It is doubtful whether it will be possible to dispense with the heavy lead dish which is usually provided in the case of a Glover tower. (2) Again, one of the most vulnerable connections of a sulphuric acid plant is the packed lead collar of the burner pipe. How a perfectly tight joint is to be made and maintained in order for a period of five years, to the satisfaction of the Alkali Inspector, is a matter that will need most careful consideration.

It has also been suggested that new plant for sulphuric acid production should be of the intensive type, an overriding consideration being the saving of chemical sheet lead. The position concerning chemical sheet lead needs to be critically examined. Thirty years ago

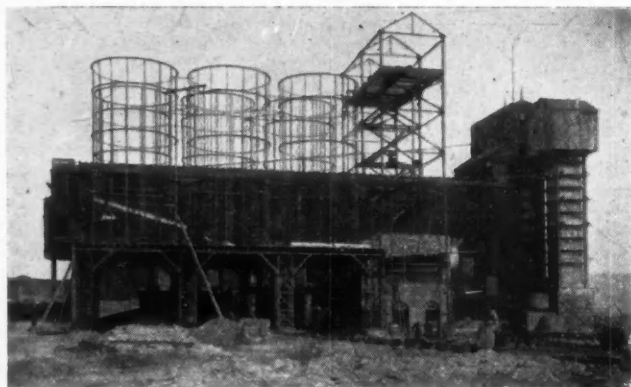


Fig 1. Background, sulphuric acid plant of wooden construction with rectangular chambers 20ft. high and about 100ft. long. Foreground, first complete unit of Moritz tower chambers, 14ft. 6in. in diameter by 32ft. 6in. high, erected in this country in 1912.

called for during 1942. It has been strongly recommended that leadless Glover and Gay-Lussac towers should be constructed of acid-resisting bricks, employing suitable cement. While it is not difficult to build a leadless Gay-Lussac tower in acid-resisting bricks and suitable acid-resisting cement, it is not so easy to construct a Glover tower, where the conditions are more stringent than with a Gay-Lussac tower. The burner gases entering the connecting pipe to the Glover tower from the stalk may range in temperature from 800°C to 350°C ., dependent on the nature of the sulphur material used, the presence or otherwise of an electrostatic precipitator, where heat is dissipated, and whether the plant is being worked intensively or otherwise. It would seem that there are

sulphuric acid plants were constructed largely of pitch pine, the chambers were rectangular, and they were of the order of 20 to 25 ft. high. This type of construction is not without some merit. Such chambers are partially housed, and if care, originally, has been given to the hanging and strapping of the lead sheets, and repairs promptly executed, the chambers can serve for twenty years before needing to be renewed. It is true that one ton of chemical sheet lead is involved per ton of 80 per cent. acid manufactured per week. A sulphuric acid unit of the type in question is shown in the background of Fig. 1. In the foreground is seen the skeleton steelwork for a series of six Moritz circular tower chambers. Incidentally, this was the first complete unit of this type erected in this

country. The tower chambers in question were 32 ft. 6 in. high and 14 ft. 6 in. in diameter. Chambers of this type do not appear to have been very popular, and it is doubtful whether they ever worked at a lesser space-time factor than 7 to 8 cu. ft. of chamber space per pound of sulphur burned per 24 hours.

Fig. 2 shows a Gaillard-Parrish installation in course of erection. These tower chambers are 42 ft. 6 in. high by 22 ft. 6 in. diameter, and the quantity of lead involved in their construction was 0.6 ton of 80 per cent. acid manufactured per week. A feature of the Gaillard-Parrish system is that the lead walls are irrigated with cooled chamber acid of a specific gravity of 1.5, and this quantity of acid represents about 20 per cent. of the total acid which is dispersed by the turbo dispersers within the chambers. One unit of plant has worked for nearly thirteen years now, at a space-time rate of 3 cu. ft. of chamber space per pound of sulphur per 24 hours.

The leadwork of the exposed type of tower chamber is subjected continually to wind pressure and minor pulsations, which ultimately affect the molecular structure of the lead and cause premature fracture. Apart from this the nitrous chamber, like all nitrous chambers of whatever type, is subjected to greater corrosion than the leading, or producing, chambers. Indeed, it would seem that the final chamber of any sulphuric acid set should be built of acid-resisting blocks, the joints of which should be made with an acid-resisting cement. This would certainly economise lead, and there is no reason why such chambers should not have a life of twenty to thirty years. The rectangular type of chamber, about 20 to 25 ft. high, was built for £1 per ton of lead in 1911. To-day it would cost £3 per ton of lead. Circular tower chambers in 1930 cost about £5 per ton of lead: to-day they will cost £10-£11 per ton of lead. Erection costs, therefore, are such that one cannot very well afford to construct chambers for a life of five years only, as has been suggested.

Housed hexagonal tower chambers (Gaillard-Parrish type), such as are shown in Fig. 3, can be erected to-day for about £5 per ton of lead, and as their life need not be less than twenty years, subject to reasonable care, it is felt that such tower chambers should be built of

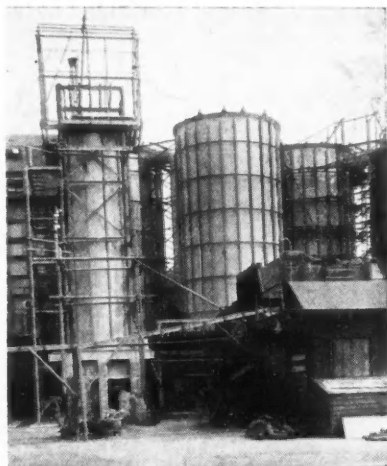


Fig. 2. Gaillard Parrish exposed tower chambers, 22 ft. 6 in. in diameter by 42 ft. 6 in. high, in course of erection (lead supported in a steelwork frame).

chemical sheet lead of not less than 8 lb. per sq. foot. It has been determined that hexagonal chambers can be irrigated with cooled chamber acid practically as successfully as circular tower chambers, and the flexibility and resilience of the internally acid-cooled cham-

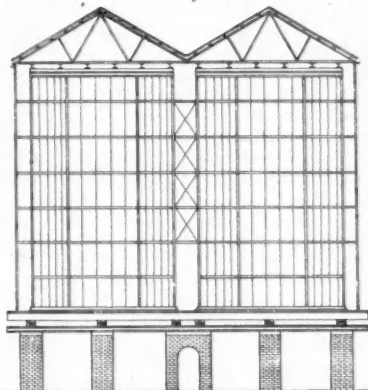


Fig. 3. Hexagonal tower chambers (Gaillard-Parrish system) protected or "housed."

ber as a production unit is little short of remarkable.

One of the war problems is to continue to maintain sulphuric acid units in

operation so that the tempo of production is unimpaired. Various expedients can be resorted to in order to attain this end, especially where a number of units of plant are concerned. Gay-Lussac towers can be by-passed and renewed; similarly, chambers can be by-passed, the old construction dismantled and renewed. But one cannot renew a Glover tower or a burner pipe connection without adversely influencing the production programme. The only possible alternative is to erect an additional set of burners (mechanical or hand-operated, as the case may be), a Glover tower, stalk, and burner pipe, and to use these as a flexible element during the time when other similar components are being rebuilt. This would appear to represent the cheapest and most practical method of ensuring continuity of operation, so essential to-day. Ultimately, the new Glover tower and its components can form part of a new unit, eventually bringing them again into service.

Chamber Process Kinetics

The kinetics of the chamber process have been examined by F. H. Peakin.¹⁴ Theoretical values for chamber space are calculated from velocity coefficients of the reaction $2\text{NO} + \text{O}_2 \rightarrow \text{N}_2\text{O}_4$, which is assumed to be the limiting factor. Under typical technical conditions the theoretical space is 1 cu. ft. per lb. of sulphur per day, a much lower figure than the value of 7–15 found by experience. It is concluded, therefore, that other slow reactions are involved, e.g., diffusion from gas to liquid phase. From a consideration of thermal data it is calculated that the cooling surface required for a rectangular chamber is approximately 1 sq. ft. per lb. of sulphur per day, and this figure is in fairly close agreement with actual practice. The results of these investigations emphasize the necessity for some form of artificial cooling if intensive operation is desired. The proportion of air required to be added to an NO-N_2 mixture to obtain maximum speed of oxidation of the NO is calculated from

$$d[\text{NO}_2]/dt = k[\text{NO}]^2 [\text{O}_2]$$

This value is 50 per cent. when the $[\text{O}_2] = 7$ per cent. by volume. The optimum operating conditions for a Gay-Lussac tower involve rapid oxidation combined with limitation of gas volume, and a ratio oxidation-speed/gas-volume,

for which the term "Gay-Lussac index" is suggested, is shown to be a maximum when $[\text{O}_2] = 5.25$ per cent. A mathematical consideration of the time equation for the calculation of the velocity of oxidation of nitric oxide to nitrogen peroxide is also contributed by F. Perktold.¹⁵ Examples of the application of the equations to the reactions of the chamber process are given.

Sulphur Materials

Erection has begun of a new large-scale pilot plant for the recovery of elemental sulphur from SO_2 -containing gases in Southern Arkansas gas field. It is understood that the process to be used is a modification of the old Claus kiln, and is to be licensed under the Norwegian Orkla patents.

Opportunity has been afforded of adapting mechanical pyrites burners to the combustion of spent oxide. The rate of combustion of spent oxide is appreciably greater than that of pyrites, and to avoid local overheating adjacent to the rotary feed it is desirable to by-pass the first shelf, and deposit the spent oxide on the second, near the outlet of the third shelf. Similarly, as a further precaution the passage of the burner gases is diverted from the falling material towards the outlet of the burner, six ports on one semi-circular portion of the top shelf being closed, and the remaining six ports being doubled in area. It has also been necessary to admit the bulk of the air for combustion to the shelf on which the spent oxide is fed. Fig. 4 shows these adaptations diagrammatically, and indicates the type of rotary feed which has been found, in practice, to be most suitable for ensuring a uniform supply of spent oxide without hitch. The feature of the arrangement is that the arms of the rotary feed have only a knife-edge contact with the housing, thus reducing the possibility of jamming.

Ten-ton mechanical spent oxide burners of the Harris type have been erected and placed in close contiguity to the Glover tower. The Harris burner does not embody a dust chamber, as the burning spent oxide is on its descent separated from the ascending burner gas. Thus, there is less surface of brickwork for radiation, and hence unusually high temperatures on entrance to the Glover tower occur. Indeed, a

temperature of 800°C . is reached, and this is undesirable, as the chamber acid fed to the Glover has to be diluted with

No details of the economics of the process are yet available.

Considerable progress has recently

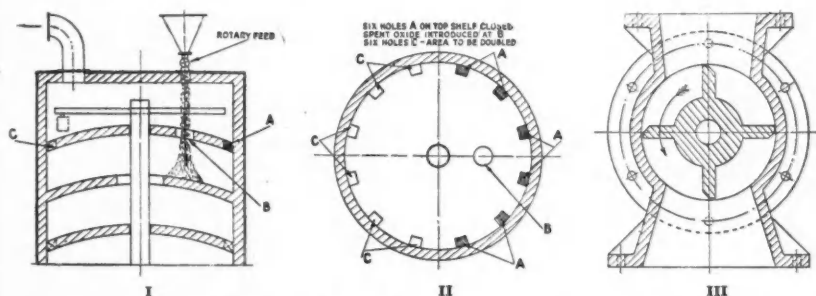


Fig. 4. Diagrammatic sketch of mechanical pyrites burner, showing adaptations necessary for spent oxide combustion. I. Sectional elevation; II. Plan; III. Section of rotary feed (speed 1 r.p.m.)

water, and derangement of the normal functions of the Glover tower results. It is wrong to conclude, however, that more heat is generated in the combustion of spent oxide than when pyrites are being burned; 2915 calories are generated per gram of sulphur to pyrites (Sommermeier), whereas 2170 calories are generated per gram of sulphur in the case of spent oxide (Berthelot).

A new solvent process for the extraction of sulphur from gasworks spent oxide that appears to offer several advantages over usual methods is described in a patent granted to R. Syers and F. W. Berk.¹⁶ The principal feature is the use of a single solvent to extract successively tar and sulphur. Tetrachlorethane dissolves tar readily at all temperatures, but dissolves sulphur only to the extent of 1 per cent. at 15°C . and approximately 20 per cent. at 115°C . In carrying out the process, therefore, the spent oxide is first washed with the solvent at about 70°C ., when practically all the tar is removed, but only a small proportion of the sulphur. After the separation of the tarry solvent the mass is covered with a fresh quantity of tetrachlorethane and the temperature raised to boiling point (130°), whereby a substantially pure solution of sulphur is obtained. The solvent can be recovered from the tar almost quantitatively and no vapour absorption plant is needed. Less than 1 per cent. of the sulphur is lost in the tar and the sulphur obtained contains less than 0.5 per cent. of tar.

been made in methods for the production of concentrated nitric acid. The combustion of ammonia in air or oxygen produces gaseous products which, when condensed and absorbed, yield an acid containing 50 to 60 per cent. nitric acid. Concentration of this weak acid involves either (a) distillation in the presence of a dehydrating agent—usually sulphuric acid—or (b) treatment of a mixture of dilute nitric acid and nitrogen tetroxide with oxygen under pressure. One of the disabilities of the first method is the necessity for circulating and continuously concentrating relatively large quantities of sulphuric acid.

E. I. du Pont de Nemours & Co.¹⁷ have proposed an interesting modification of the usual process. Preheated concentrated sulphuric acid, together with dilute nitric acid, are fed to the top of a tower at about 110°C . and hot sulphur trioxide (produced by heating oleum), is introduced near the tower base. Nitric acid of 95 per cent. concentration is distilled and enriched with sulphur trioxide for further use. The process can only be used, of course, in conjunction with plant for the production and absorption of sulphur trioxide.

A review of recent developments in high-pressure processes is contributed by A. H. Manning.¹⁸ The ammonia oxidation process is carried out by the combustion of ammonia in pure oxygen, steam being added to the mixture to prevent explosions and excessive temperature. Precautions are also taken to pre-

vent premature combustion and "flashing back." After passage through the gauzes the products of combustion are cooled by passage through a waste heat boiler. Condensate consisting of very weak nitric acid is thus separated and discarded, while the remaining gas mixture is further cooled and oxidised to produce a condensate containing approximately 50 per cent. nitric acid. Further cooling produces acid of 70 per cent. concentration and a gaseous residue consisting of practically pure nitrogen tetroxide, which is condensed in a brine-cooled liquefier. The dilute nitric acid and nitrogen tetroxide are then mixed in such proportions that the $\text{HO}_2:\text{NO}_2$ ratio conforms approximately to the proportions required by the equation $2\text{H}_2\text{O} + 2\text{N}_2\text{O}_4 + \text{O}_2 = 4\text{HNO}_3$, and the mixture is transferred to an autoclave for treatment with oxygen under a pressure of 50 atm. The final process is degasification and bleaching to remove excess nitrogen tetroxide. Modifications of this basic process have been proposed from time to time. The tendency of development is towards continuous oxidation of the dilute nitric acid/nitrogen-tetroxide mixtures, although practical difficulties have so far proved a deterrent to large-scale plant construction.

Hydrochloric Acid

There has been a growing tendency to adopt mechanical means for the production of salt cake in this country recently, presumably because a better quality material is obtained, and skilled labour is not available for operating manual furnaces. Certainly, mechanical movement of the salt undergoing decomposition with sulphuric acid produces a friable, crisp salt cake. What has not, apparently, yet been decided is whether a cast-iron muffle provided with shaft, arms, and rabbles possesses advantages over a special brickwork muffle similarly equipped. With cast iron there are no joints: with special brickwork there are many joints, and potential possibilities for leakage of nitre cake. Generally, the bottom cast-iron pan is so arranged that there is a thin covering of nitre cake acting as a protective film, and thus avoiding the introduction of iron to the salt cake. But the passage of heat through nitre cake, or ultimately salt cake, must increase the fuel consumption figure, and one recalls the old Jones type of

mechanical furnace, where direct heat was applied to the salt undergoing decomposition with sulphuric acid on a mechanically rabbled cast-iron bedplate covered with nitre cake as a protective medium against corrosive attack. One marvels at the satisfactory fuel figure obtained under those conditions, but recalls the complaint occasionally made about the sulphuric acid content of the resultant hydrochloric acid.

But there are obvious advantages and disadvantages in the two arrangements. If one saves fuel in an open mechanical hearth, then the hydrochloric acid gases are diluted with nitrogen, CO_2 , and possibly SO_2 , and a larger condensing plant must be provided. Broad experience suggests that it is preferable to sacrifice economy of fuel to ensure a compact condensing unit for the hydrochloric acid gas, such as is illustrated in Fig. 5, where the principal elements of a mechanical salt-cake furnace are shown. The approximate capacity of this mechanical furnace, dependent on the quality of the salt, is 6 to 8 tons of salt, 96 per cent. NaCl , per day of 24 hours, yielding approximately $7\frac{1}{2}$ to $9\frac{1}{2}$ tons of salt cake, 97 per cent., and 10 to 13 tons of hydrochloric acid, 30 to 31 per cent.

To determine the throughput of a cast-iron salt-cake pot, it can be assumed that, theoretically, 850 B.Th.U. are required per lb. of salt cake produced. Singularly, few furnaces (manual or mechanical) operate with a greater efficiency than 25 per cent. Therefore:—

360 sq. ft. (surface of pot and cover shown) \times 8000 B.Th.U./sq. ft./hr. (calculated rate of heat transmission)

3440 B.Th.U. (heat required per lb. of salt-cake, based on an efficiency of 25 per cent.)

$= 7\frac{1}{2}$ cwt./hr. \times 24 hrs./day = say 9 tons of salt-cake.

It is conceivable that by increasing the CO_2 content of the flue gases to 14 per cent., a better utilisation of heat would be effected. A greater throughput can be obtained if one is content to accept a lower efficiency than 25 per cent., because the rate of transmission depends on the rate of heat input. It is assumed that the radiation loss is of the order of 15 per cent.; hence the loss of efficiency is approximately 60 per cent., due to the sensible heat of the flue gases. This loss

could be utilised (a) by imparting heat to the sulphuric acid to be used for the decomposition of the salt and (b) by drying and heating the salt. For the foregoing purposes, of course, additional equipment would be required, and the cost of this must be offset against the economy of fuel consumption.

Activated Carbon: Gas and Fuel

High-quality coal can be reduced to low-temperature coke and then treated with air just below ignition temperature. This affords partial activation. Ordinary

Will high-pressure gasification be the process of the near future, or will improvements in existing processes (inter-

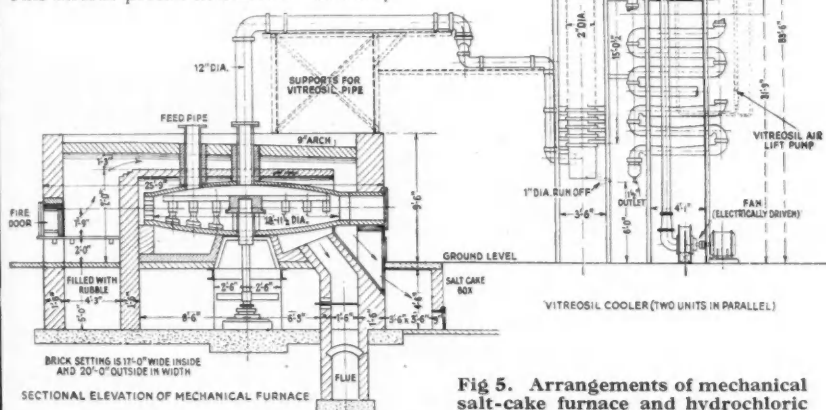


Fig 5. Arrangements of mechanical salt-cake furnace and hydrochloric acid condensing plant.

hardwood charcoal and the low temperature oxidised cokes are ground to pass 200-mesh screen, mixed with high-melting pitch, heated in the dry powdered state, and forced through extrusion dies by means of a suitable press. The extruded material is passed through low temperature carbonising, high temperature carbonising, air activation and steam activation in steps to produce a fine grade of gas-mask charcoal. Despite the fact that this process involves numerous steps, the raw materials are available in unlimited quantities, at comparatively low prices. In some cases sawdust is fed to a suitable hammer mill and compressed into logs. These can be carbonised under pressure to produce a charcoal having the density of ordinary coal, and the ease of activation of wood charcoal. Once the logs are formed and converted into dense charcoal, the procedure for conversion to activated carbon is essentially the same as in activating a briquetted material.

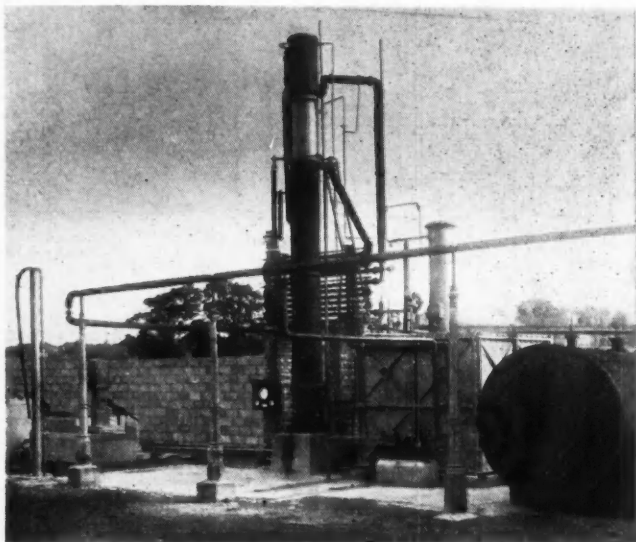
mittent verticals, continuous verticals or horizontal retorts), be the order of the day? Dr. Pexton has adjured the industry not to build unwarranted hopes on the outcome of Dr. Dent's work at Leeds for the Institution of Gas Engineers. He says: "The industry would be well advised temporarily to forget that Dr. Dent was patiently working on new processes, and to apply its own improvements to existing methods." Attempts to improve the thermal efficiency of gas manufacture are being made. How best to utilise the sensible heat of (a) the hot coke, (b) the distillation gases, and (c) the flue gases, is a matter for consideration by both gas engineers and contractors. Vertical retorts have recently been increased in height, at correspondingly increased expense, in order to combine coke with water-gas production, but whether such a step can be justified, when only three therms are absorbed by steam heating and production of water-gas, seems doubtful.

The idea of cooling the coke and manufacturing water gas *in situ* should conceivably be abandoned, and a pre-determined portion of the hot coke should be dropped to the generator of a water-gas plant, and advantage taken of the sensible heat there. Water-gas (CO and H_2) in turn should be synthesised to methane.

From time to time a call is made to get rid of coke as a "crude and inconvenient domestic fuel"; yet it is not unlikely that immediately after the war there will be a cry for smoke abolition and the economic conditions of the average family may dictate that coke of low-temperature fuel shall hold the field. Dr.

Engineers, Mr. E. V. Evans, O.B.E., has delivered several thought-compelling addresses during the last few months, and has thrown fresh light on the latent possibilities of the gas industry, and has observed that it is "afire with enthusiasm." The contribution of the gas and coking industries to the war effort, in the production of benzene, toluene, phenol, creosote, xylol, cresols, tar acids, ammonium sulphate, liquid pitch-creosote fuel mixtures, sulphur material, and other products, is an important one, but perhaps it would be unwise to stress this aspect unduly at this juncture.

Fig. 6. Plant for production of concentrated gas liquor, 20 per cent. ammonia by weight, erected by Newton Chambers & Co., Ltd. (vapour phase process).



Pexton, in confirmation of a view that his chief, Dr. Hollings, expressed four years ago, has observed: "The great intrinsic value of coke should be recognised: well-screened coke from continuous verticals was almost an ideal smokeless fuel for long-period domestic room heating or water heating." Technicians will presumably always reveal independence of thought: one can hardly expect unanimity of view. But the initial task of the gas industry is to displace coal used at the domestic grate, and when this has been done, then the fate of coke of indifferent quality, if any, can be determined.

The President of the Institution of Gas

Further increases in the demand for ammonia have resulted in greater attention to plant production efficiency, particularly in the case of by-product ammonia recovery. Many new plants have been erected for the manufacture of concentrated gas liquor ammonia. The design of these plants largely follows established practice, though modifications have been introduced in certain cases to increase efficiency and improve controllability. Fig. 6 shows a typical concentrated gas liquor plant of the vapour-phase type, erected in the south.

(Continued on page 73.)

The Nitrogen Industry in 1942

by

E. B. MAXTED, D.Sc., Ph.D., F.I.C.

WHILE the nitrogen industry, under the influence of the war, has been passing through a phase of great general activity throughout the world, political conditions have, as was to be expected, prevented the publication of details of this development; and any review of this field has, for the time being, to be limited to a notice of some of the relatively small number of articles and patents which are now being published.

Ammonia

There has been some continuation of the Russian work on basic data underlying the synthesis of ammonia; and, although the journal articles referred to below date from 1940, they have not been included in previous reviews of this series owing to delays in their general availability either as such or in abstract form. V. G. Telegin, N. V. Sidirov and K. B. Schpulenko (*J. Appl. Chem. Russ.*, 1940, 13, 823; ex *Brit. Chem. Abs.*, 1942, B, 1, 98) have investigated quantitatively the influence of variations in the alumina content of iron-alumina catalysts on the activity. S. S. Latschinov (*J. Phys. Chem. Russ.*, 1940, 14, 1260) has studied the course of the reduction of iron-alumina-potash catalysts with special reference to the activity of the reduced catalyst and to its susceptibility to poisoning. Such catalysts were found to be more active if reduced at 500° than at 375°; further, the activity was favoured by a high flow-rate of the reducing gas. Work was carried out on the inhibition of the synthesis by traces of water and fully reduced catalysts were observed to be more susceptible than partially reduced ones. Two papers dealing with the mechanism of the synthesis may also be noted. P. V. Usatshev (*J. Phys. Chem. Russ.*, 1940, 14, 1246; ex *Brit. Chem. Abs.*, 1942 B, 1, 340) have observed that the synthesis is temporarily inhibited by the previous saturation of the catalytic surface by nitrogen, but not by pre-treatment with hydrogen. K. T. Koshenova and M. T. Kagan (*J. Phys. Chem. Russ.*, 1940, 14, 1250; ex *Brit. Chem. Abs.*, 1942, B, 1, 340) find that if the normal flow of nitrogen-hydrogen mixture is interrupted by the passage of nitrogen the formation of ammonia ceases abruptly, whereas if a mixture of hydrogen and water (or hydrogen alone if the catalyst is not completely reduced) is passed, after discontinuance of the normal hydrogen-nitrogen feed, ammonia is still produced for several minutes. This is viewed as meaning that, in the latter case,

Dr. E. B.
Maxted.



the hydrogenation of previously adsorbed nitrogen constitutes the source of the ammonia formed; but the observations in this paper should also be considered from the aspect of Usatshev's results.

Since the purification of hydrogen from catalyst poisons is of special interest in the synthesis of ammonia, mention may be made of a recent patent of the Power Gas Corporation and others (B.P. 543,923), describing the removal of hydrogen sulphide and carbon dioxide from commercial hydrogen by a process of a two-stage wet-absorption type in which the gas is first treated with an aqueous carbonate solution to remove the greater part of the hydrogen sulphide and subsequently with an aqueous base capable of forming a carbonate, whereby the remaining impurities are eliminated, the spent liquor from this second stage being used to feed the first absorber.

Turning to ammonia generally, M. Alfs (*Glückauf*, 1942, 78, 107) has discussed steam economy in ammonia stills; and J. Rae, together with Clay and Wilbraham (B. P. 541,914), has described a method for the retention of ammonia gas in a solid or unspillable form by the use of a fatty alcohol, such as cetyl or stearyl alcohol, or a suitable ester (e.g., a phosphate or sulphinate) of such alcohols.

Ammonium Salts

Two papers dealing with the production of ammonium sulphate may be noted. In the first place, this subject has been reviewed generally by W. Tiddy (*Gas J.*, 1942, 239, 325). Secondly, G. Claude (*Compt. Rend.*, 1941, 213, 332) has dealt with the preparation of ammonium sulphate from gypsum and has proposed modifications involving the precipitation of the sulphate by adding ammonia, followed by carbon dioxide, to a saturated solution of ammonium sulphate in such a way that the pure ammonium salt is precipitated and a suitable mother liquor obtained for reaction with calcium sulphate. The modification avoids the evaporation of the solution; and the greater part of the

ammonium sulphate obtained by the double decomposition of the calcium sulphate with the ammonium carbonate can be separated mechanically from the more easily suspended calcium carbonate. The preparation of ammonium sulphate by a modified ammonia-soda process from the mineral mirabilite has been described by A. P. Belopol'skii (see *Amer. Chem. Abs.*, 1942, 36, 5961). The manufacture of ammonium chloride by a process of which a solution of hydrochloric acid of suitable strength is prepared by allowing the gas to pass at 70° counter-current to water, following which this solution is treated with gaseous ammonia and cooled to precipitate the ammonium chloride, has been claimed by W. Hirschkind (U.S. P. 2,133,513).

Among processes dealing with other ammonium salts, the method proposed by L. C. Jones (U.S. P. 2,232,241) for the production of ammonium sulphamate may be noted. This involves the interaction of sodium chlorosulphonate (ClSO_3Na) and liquid ammonia. The ammonium sulphamate ($\text{NH}_2\text{SO}_3\text{NH}_4$) is separated by evaporation of the solution. Finally, the preparation of ammonium thiocyanate has been dealt with by L. L. Lento and D. W. Jayne (U.S. P. 2,249,962), who state that the formation of ammonium thiocarbamate, by the interaction of carbon disulphide and ammonia in aqueous alcoholic solution, is catalysed by the presence of a fatty acid or of an ammonium salt of this. The thiocarbamate is converted into ammonium thiocyanate by subsequent distillation, the alcohol being also recovered at the same time.

Nitric Acid and Nitrates

Several patents have appeared covering modifications in methods of recovery of the platinum metals lost from gauzes used as catalysts for ammonium oxidation. Thus, G. M. Chastain (U.S. P. 2,226,113) proposes the interposition of a glass wool or quartz wool filter between the catalyst and the condenser. Baker and Co. and the Hercules Powder Co. (B. P. 542,330) claim the use of porous metallic filters. A somewhat similar method to the above is due to F. Zimmermann (U.S. P. 2,226,149). The reactivation of cobalt oxide catalysts which have been used for ammonia oxidation is treated by V. M. Stone (U.S. P. 2,231,202). The oxide is reduced to metal by employing the synthesis gases from a synthetic ammonia plant and the metal is then re-converted to the oxide by dissolving it in nitric acid and subsequent ignition of the nitrate. It may also be noted that A. Cheutin (*Compt. Rend.*, 1941, 213, 26) has observed that the activity of a platinum catalyst for the decomposition of nitrous oxide increases after the platinum has been used for some time. This has, of course, long been known for ammonia oxidation.

The further oxidation, condensation, and absorption of nitrogen oxides under pressure is becoming of increasing importance, particularly in the type of ammonia oxidation process in which oxygen, diluted with steam, is used in place of air. I. Hechenbleikner (U.S. P. 2,138,165) has described suitable plant for this; and the subject has also been treated in detail by A. H. Manning in a recent lecture—which has, however, not yet been published—at a joint meeting of the Society of Chemical Industry and the Chemical Engineering Group. Special procedure in the bleaching of nitric acid from ammonia oxidation is contained in a patent of S. L. Handforth and J. N. Tilley (U.S. P. 2,142,646).

In connection with the concentration of nitric acid with sulphuric acid, W. E. Sellick (*Ind. Eng. Chem.*, 1941, 33, 1248) has published graphs relating to the distillation of nitric acid from various nitric acid/sulphuric acid/water mixtures; and a concentration method involving the passage, downwards, of dilute nitric acid and sulphuric acid in countercurrent to sulphur trioxide in a packed tower has been described by F. Carl (U.S. P. 2,139,721).

H. A. Beekhuis (U.S. P. 2,124,536) has proposed a modification in the preparation of sodium nitrate from sodium chloride. The mixture of nitric acid and aqueous sodium chloride is heated to remove nitrosyl chloride, then passed through a hot stripping column and cooled to deposit sodium nitrate. The mother liquor is concentrated under conditions such that as little acid as possible distills over with the water and, after further crystallization of sodium nitrate by cooling, the liquor is again used in the process.

The extraction of hydrocyanic acid from coke-oven gas by scrubbing with water at room temperature, followed by the aeration of the solution to remove hydrogen sulphide and by the subsequent removal of the hydrocyanic acid by the passage of an inert gas through the liquid, is the subject of a patent of F. W. Sperr (U.S. P. 2,143,821). W. B. Tanner (U.S. P. 2,138,519), in connection with the production of alkali cyanides by the reaction of hydrocyanic acid with an alkali carbonate at 475°, has described the use of plant consisting of a horizontal reaction vessel provided with a helical conveyor which prevents sintering; and special conditions for the direct formation of crystalline sodium cyanide from concentrated soda solutions and hydrocyanic acid have been claimed in B. P. 540,062 (S. A. La Floridienne, J. Buttgenbach and Co.).

Finally, although it deals with elementary nitrogen rather than with nitrogen compounds, a paper by O. G. Pamel-Evans (*Metallurgia*, 1942, 25, 116; ex *Brit. Chem. Abs.*, 1942, B, 1, 227) is of general interest for reactions requiring nitrogen free from oxygen.

Research Work in the Food Industry

by

FRANCIS H. BANFIELD, M.Sc., Ph.D., F.I.C.

THE war continues to exercise an important directive influence on the nature of most researches carried out for the food industry. A much smaller proportion of papers are of purely academic interest. Difficulties of transport and lack of ample refrigerated ships have led to a revival of the interest in dehydrated meat. Preliminary work of recent date has been conducted in England and overseas on the batch principle, but it is evident that in America at least one plant is working a continuous process (1). The same lack of refrigerated ships has led to the use of lard as an insulating material.

Bacon and Ham Curing

Shipments of frozen meat and other perishable material have been successfully transported surrounded by boxes of lard (2). White and his colleagues have continued their studies on Canadian Wiltshire bacon, the series of papers now exceeding 20. Parts 20 and 21 deal respectively with the flavour of the bacon and its relation to the treatment during curing, and the characteristics of pork fat which are predominantly responsible for the rancidity of the bacon (3). In connection with the curing of hams, an art at present not practised commercially in this country, Jensen and Hess (4) have recently published a very informative paper based on an examination of 450,000 hams in their study of the causes of ham souring. Their findings should go far to eliminate a very troublesome problem once curing recomences in this country.

Meat Research

Hammond (5) continues to study the composition of meat as affected by nutrition and the state of maturation of the animal. This type of research is vital now that it is essential that we should slaughter our animals when the carcass yield and quality of the meat is at the optimum, bearing in mind the question of the cost of feeding. In connection with judging the carcass quality of pigs, Bolton and Baskett (6) have found an extremely good correlation between the iodine number and the mechanically measured firmness of pork fat. Bate-Smith (7) has reviewed the chemical composition of meat from various animals, and Baker (8) has studied the effect on meat of the various methods of cooking by water, steam and dry heat. The changes occurring when meat is hung after slaughter have been examined by McCarthy and King (9) who have compared the changes taking

place at the "normal" temperature of 1.67°C. during 30 days with those occurring during 48 hours at the elevated temperature of 15.56°C. in the presence of ultraviolet radiation from special lamps. The rapid "tenderising" is made possible by the prevention of bacterial deterioration in the presence of the radiation. Jenson (10) has patented a process for the tendering of meat by treatment with organisms of the *Aspergillus flavus-oryzae* group. This recalls the much publicised method whereby pineapple juice is used for a similar purpose, the enzyme of pineapple, bromelin, being similar in its action to papain derived from the leaves of the papaya (11). The examination of the changes taking place during the smoking of meat and fish will be facilitated if use is made of Tucker's method (12) of estimating phenol and guaiacol in meat and fat. The colours developed with 2,6-dichloroquinone chloroimide are examined photo-electrically.

Evaporation and its Prevention

Heller (13) has studied the loss of water from the surface of meat and finds that down to a weight loss of 40 per cent, the evaporation is similar to that occurring from the surface of water. Dickinson (14) has patented a process for the application of a film of nickel pectinate to meat to prevent spoilage and evaporation during storage. The study of the stability of fat against rancidification has been continued by Sylvester, Lampitt, and Ainsworth (15) who have designed an apparatus to record the oxygen absorption occurring when the fat is heated to any temperature.

Shewan (16) has examined the numbers and types of bacteria found on fish immediately after removal from the sea and during stowage before landing from the boat. He also relates freshness with the content of di- and trimethylamine of the muscle, while Charnley and Goard (17) relate the pH of the extract from fish with the freshness. Clague (18) has confirmed his previous work in which he showed that the fatty acid content of canned fish may be used as an index of the quality of the fish before canning. Cutting (19) has studied the design of smoking kilns for fish. He suggests that kilns can be made which are suitable not only for smoking but also for drying fish and for thawing frozen fish from store. As an example of the trouble taken by manufacturers over what may seem to be trifles, the use of a special machine to

remove the dark veins from shrimps before packing may be quoted (20). Specially coated rubber rollers are employed.

Much attention has been focussed on the various cereals as staple articles of diet. Moran and his colleagues (21) have reported on the chemistry of wheat, the composition of grain and the effect of milling. Moir (22) has similarly discussed oats and oatmeal, while Ford (23) has collected data for maize, rice, rye and barley. In connection with the addition of *creta praeperata* to flour, Moran and Hutchinson (24) and McCance and Widdowson (25) have studied the various aspects of the calcium requirements for adult life. The addition of calcium to bread has stimulated the interest in phytic acid which affects the absorption of calcium and iron by the body. Pringle and Moran (26) have studied the destruction of phytic acid during baking and have found that the normal loss of 50 per cent. is affected by the pH of the material and the nature of any calcium salts present. It was anticipated by some that the addition of calcium to bread would affect the pH and result in the easy development of those organisms responsible for rope in bread. Halton (27) reports that most reliable results for the pH of bread are obtained if the quinyhydrone is kneaded into the crumb. Aqueous extracts of bread give unreliable results. He found a very small change in the pH due to the addition of calcium as *creta praeperata*. Glabe (28) announces the use as a rope and mould inhibitor of a compound called sodium diacetate formed from sodium acetate and acetic acid.

Studies of Flours

Fuller (29) advocates the use of photography as an aid to scientific control in bakery production to disclose trends in departure from any standard laid down. Amos (30), in reviewing briefly some of the fundamental processes occurring during the fermentation of dough, calls for more fundamental work of apparently academic interest but of vital importance. Soya flour is becoming increasingly available in a specially treated form whereby most of the oil and the characteristic bitter flavour have been removed. Beckel, Bull and Hopper (31) have studied the denaturation of the soya proteins which occurs to varying degrees during the moist heat treatment which is part of the processes referred to above. They find the denaturation to be complete at 127°C. and 100 per cent. relative humidity in 2½ hours. Barker (32) discusses the production and use of the various types of potato flour now available as substitutes for flours in short supply.

Dehydration of vegetables has created much interest. Cruess and Mrak (33, 34) in

two series of articles have dealt informatively with the subject as seen in America. Brief descriptions of two British vegetable dehydration plants have also been given (35, 36). Adam, Horner and Stainworth (37) have studied the blanching of vegetables, a process which precedes both drying and canning. They recommend that owing to losses of various nutrients the blanching time should be kept as short as possible. The American practice of adding calcium chloride to tomatoes before canning (38) to prevent breakdown of the fruit during processing and transport and which has been approved by the Food and Drug Administration, has been shown by Loconti and Kertesz (39) to be due to the formation of calcium pectate.

Pectin

The shortage of pectin has added interest to the observation by Baker and Goodwin (40, 41) that partially demethylated pectin will give good gels with a lower percentage of soluble solids. It should be noticed in this connection that the keeping qualities of such gels are lowered at the same time. Nutting (42) reports preliminary work on the study of the blackening of cooked potatoes. The pigment which is being examined through its absorption spectra is not formed by enzyme action, but is due to oxidation and its formation may be partially prevented by using cooking water at a pH 4.1-4.9. Nolte, Pulley and Van Loesecke (43), in their study of the use of antioxidants in canned orange juice, have indicated the existence of three induction periods due probably to terpenes, fats, and resins respectively.

Rosser and colleagues (44) have examined 21 methods for preserving eggs in unrefrigerated storage and obtained the best results by treatment of the surface with dimethylolurea followed by vaseline. Hawthorne and Bennion (45) have devised a method for evaluating dried egg for use in bakery products. Hollender and Tracey (46) have found that as antioxidants for dried whole milk powder hydroquinone (10 p.p.m.) is the best but ascorbic acid (0.01 per cent.) and sodium citrate (0.2 per cent.) also gave some protection. Avenex coated bags for the powder were found useful, but Jack and Henderson (47) recommend the addition of Avenex to the milk. Rowland (48) has studied the variation of solids-not-fat in milk particularly in connection with sub-clinical mastitis, and Davis (49) discusses the resazurin test for evaluating the keeping quality of milk and compares its value with the methylene blue test. The utilisation of whey is discussed by Smillie and Wight (50, 51) who point out that whey contains 6 per cent. of the solids, 90 per cent. of the vitamin B, 75 per cent. of lactoflavin, and 90 per cent. of the original

calcium of milk. Whey powder in a form suitable for confectionery, bakery products, and soups is discussed as also is the production of a substitute for buttermilk. Lavett (52) has patented certain improvements relating to the drying of whey, while Browne (53) has studied the fermentation of whey by various yeasts and tolulæ with a view to its use during the present emergency. Kerr (54) has examined the production of metal foil for milk bottle caps, using metals other than aluminium. A tin-zinc alloy and tinned copper gave the best results. Since this paper was prepared the change in the tin situation has probably altered the value of the results.

Food Poisoning

The outbreaks of food poisoning from time to time in America, due to the consumption of bakery products containing custard and similar fillings and caused by organisms of the *Salmonella* and staphylococcal type, have led to a series of papers by Cathcart and colleagues (55). These workers have examined the effect of ultraviolet radiation and ozone on various bakery fillings with a view to killing any organisms of the food-poisoning type which might be present. Oxidative production of off-flavours renders such treatment unsuitable. The restraining action of any fruit juices present and the destruction of the bacteria during baking have also been studied. Erickson and Fabian (56) have studied the preserving and germicidal action of the sugars levulose, dextrrose, sucrose, and lactose for certain yeasts and bacteria. The acids lactic, acetic, and citric were also studied both singly and in combination. Yessail and Williams (56) emphasise the danger of using heavily contaminated spices in foods not to be sterilised. They recommend that, although a considerable reduction in the bacterial count takes place during normal cleansing of the spices, some special treatment, e.g., with ethylene oxide, should be used. Appling and Shema (57) emphasise that higher bacterial counts on paper and board must be expected following the use of waste paper as a raw material.

Literature on Vitamins

Vitamins are being studied on an ever-increasing scale by food technologists as well as by the specialists. In this connection at least two very valuable books have recently been published. The first has a somewhat forbidding title, forbidding that is to the chemist. It is called "The Vitamins in Medicine" and is written by Bicknell and Prescott. The book contains much that is of value to the chemist. The other book deals with the vitamins of meat and is titled "The Vitamin Content of Meat," by Waisman and Elvehjem. For those in

this country who have been unable so far to purchase this book, there is a full abstraction of the book in a paper by Bacharach (59). Pyke (60) has determined the vitamin content of different varieties of vegetables all grown in one locality, and Booth (61) has reviewed the source of supply, methods of estimation, human requirements for and stability of, carotene. Graves (62) suggests the use of different factors relating carotene and vitamin A for the green and coloured vegetable, the difference being due to variation in the absorption in the body of the carotene from these two sources. Hunter (63) discusses the chemistry of vitamin A and the biologically active carotenoids. Bolton and Common (64) have studied methods of estimating carotene in silage, and Davies (65) has emphasised the necessity of storing lucerne at cool temperatures to avoid loss of carotene.

Distribution of Vitamins

The necessity for an ample supply of vitamins for the cow is emphasised by Hauge (66) who relates the content of vitamins in the butter from the milk to that in the material fed to the animal. The change in milling procedure for flour has led to an examination of the distribution of vitamin B1 in the berry of wheat. Hinton (67) has found that the scutellum lying between the embryo and the endosperm contains 10 times the amount found in the embryo. Sherwood, Nordregren and Andrews (68) found similar variations. Herd (69) has reviewed the distribution of vitamins B1 and E1, riboflavin and nicotinic acid in various wheats, breads, and other cereal products. Dawson and Martin (70) have carried out large-scale production of bread containing added vitamin B1 and have found an average loss of 8 per cent. during baking. The Ministry of Food official method for the vitamin B1 assay of white flour has been published together with notes on the process (71). Schwartz and colleagues (72) have recommended the addition of 2½ per cent. debittered brewers' yeast to bread for the enrichment of the whole of the vitamin B complex, preliminary experiments having shown that no detectable off-flavours are developed. Van Lanen and colleagues (73) have shown that yeast under aeration will absorb vitamin B1 and also synthesise it from the intermediates pyrimidine and thiazole.

Wokes (74), using the potentiometric method of estimating vitamin C developed by Harris, Mapson, and Wang (75), has examined the production of rose-hip syrup, a valuable source of this vitamin. He has examined various methods of preparation of the syrup and its keeping qualities. Bailey (76) has also studied this product. Downer (77) has found good stability of vitamin C after addition to carbonated and sulphited

fruit juices and recommends these as vehicles for distribution of this vitamin. Rauch (78) also finds good stability of vitamin C in jams and fruit juices, while Rostovskaya (79) found only 15 per cent. loss of vitamin C during the conversion of fruit to jam. Pulp was found to lose this vitamin rapidly on exposure to air. Holmes and colleagues (80) continuing their examination of the vitamin C content of cows' milk have found no relation between the amount of vitamin in the milk and the volume of milk obtained from the cow. The state of lactation had most effect on the amount of vitamin. Bacharach and Coates (81), using the change in the capillary fragility of guinea pigs as an indicator of the presence of vitamin P, have found a water soluble extract of black currants to be 100 times as active as recrystallised hesperidin. Discussing the general fortification of foods, Amos and Kent Jones (82) have indicated some of the technical difficulties involved in the uniform distribution of the active principles, the necessary guarantee of sufficient stability and the analytical control required during manufacture.

The Uses of Soya Lecithin

The shortage of eggs for manufacturing purposes has stimulated interest in soya lecithin (83) which among other things can be used as a wetting agent in confectionery,

as a vitamin and fat antioxidant, and by its presence in certain preparations such as chocolate and ice-cream coatings, allows of a reduction in the fat content. The constituent phosphatides can be commercially extracted from soya bean oil by the method of Thornton and Kraybill (84) whereby the phosphatide fraction is absorbed on to aluminium silicate and the various components extracted by suitable solvents in turn.

Substitute Containers

Shortage of tin for tinsplate has led to an extensive examination of the use of substitutes. Sanders (85) discusses the difficulties associated with the high speed production of cans from light-weight plate, the possible production of electro-tinned plate on a large scale, lacquered blackplate (the iron base on which tin is normally applied) and the use of bondersed blackplate (blackplate covered with a microscopic phosphate film said to resist corrosion).

Trace Elements

Calvary (86) has collected published data on trace elements in foods and has grouped them under the three headings: nutritive trace elements, non-nutritive non-toxic trace elements, and non-nutritive toxic trace elements. He discusses their occurrence, nutritive value and toxicity.

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War-Time Developments in Solvents

by

ARTHUR M. PEAKE

ONE of the most interesting results of the war, and one which may have far-reaching consequences, is the rapid development of industries, including the organic chemical industries, in countries where in normal times the process of industrialisation would probably have proceeded very slowly. The causes of this are not far to seek: extension of the conflict to almost every inhabited part of the earth with increasing need of supplies for the war machine everywhere, difficulties of transport, and so on—but it is more difficult to visualise the ultimate effects. It is true that for the most part the production envisaged is relatively small compared with that in countries already industrialised, but the cumulative effect may be sufficient to have an appreciable influence on developments in the post-war period. All that can be done here is to refer briefly to progress in those countries in the branch of chemical industry under consideration.

Solvents in India

India furnishes the most striking example of the rapid conversion of an almost entirely agricultural country into one whose industries will have to be taken seriously into account after the war. In the solvent field, India already produces appreciable amounts of ethyl alcohol, acetone, methyl alcohol, and acetic acid, and the manufacture of esters such as ethyl acetate will doubtless follow in due course, if, indeed, it has not already started. An American technical mission has been in India for some time and on their recommendation the War Resources Committee has ordered twelve plants from the U.S. to increase the production of ethyl alcohol. Another recommendation of the mission is that a number of production engineers and technicians be sent from the U.S. to advise and assist in developing Indian industries. This has been fully approved by the Indian Government. It is reported also that the Government has given some guarantee that Indian industries will be safeguarded after the war.

The chemical industry has also advanced rapidly in another Asiatic country, namely, Palestine, and a factory to produce modern industrial solvents has been erected at Tel Aviv. Plans are said to be in hand for the manufacture of lactic acid. Even in unoccupied China a flourishing ethyl alcohol industry of appreciable magnitude has sprung

Mr. A. M. Peake, Distillers Co., Ltd., Research Department.



up during the past few years. In Africa, Kenya has initiated a research programme with a view to establishing chemical industries, and South Africa has expanded very considerably the existing facilities for producing organic chemicals and has widened the range of compounds produced.

With the exception of Eire, Portugal, Spain, and some of the smaller states in Eastern Europe, all the European countries had extensive chemical industries before the war. It is difficult to obtain reliable information on what is happening in countries controlled by the enemy, but some of the war-time developments in Eire and Spain are worthy of mention. For example, there are the production of relatively large amounts of industrial alcohol from potatoes in four and possibly five Irish distilleries, and the construction of factories in Spain to produce methanol, formaldehyde, solvents, and synthetic resins.

In the Western hemisphere, it is significant that appreciable quantities of butyl alcohol and acetone, as well as ethyl alcohol, are now manufactured in Porto Rico by the fermentation of molasses. The view has often been expressed that it would be more advantageous to convert molasses into useful organic chemicals "in situ" rather than transport it for treatment elsewhere. Apart from an increase in ethyl alcohol production in some localities, particularly in Brazil, little of importance in the solvents field seems to have occurred elsewhere in Central and South America.

Although strictly speaking, Australia cannot be classed among the countries already mentioned, as it had a flourishing if relatively small solvents industry before the war, the remarkable expansion thereof of organic chemical industry under war conditions is worth putting on record. Moreover, the Australian Government has sanctioned an ambitious project for the production of industrial alcohol from wheat. Four large distilleries are to be erected in

New South Wales, Victoria, South Australia and West Australia respectively, and according to information recently received in this country, that in N.S.W. is ready for operation. The already existing distilleries in N.S.W. and Queensland, utilising molasses and probably crude sugar also as raw materials, appear to be working to full capacity. In the industrial countries the production and use of solvents have been controlled by the needs of the war machine and the conversion of practically all the distilleries producing potable spirits in the U.S.A. to the manufacture of industrial ethyl alcohol, and the importation of the latter into the United Kingdom, as reported in Parliament recently, are significant examples of the changes brought about by the present abnormal conditions.

Turning to industrial groups of solvents and dealing first with alcohols, there is little to report on methanol in addition to that already mentioned, although a report has reached this country that an industrial process for the manufacture of methanol from methane has been worked out in Italy. It may be remarked in passing that although Italy has only negligible indigenous supplies of coal and oil, large amounts of natural gas are available and a considerable amount of work on the industrial utilisation of this had already been carried out before the war, by, among others, Professor Padovani, the patentee of the new methanol process. The known results of Professor Padovani's earlier investigations in this field would lead to the conclusion that the new process, on which no detailed information is available, may be of industrial importance.

Increased Alcohol Production

Already in 1941, the production of industrial ethyl alcohol in the U.S.A. showed a 40 per cent. increase over that of 1940, and there is no doubt that in 1942 a still higher figure will have been reached as, in addition to new plants constructed, a number of old and idle distilleries have been recommissioned and put into operation. The U.S. War Production Board has assessed the figure for next year's production at over half a billion gallons of industrial alcohol, of which it is estimated that sixty-five million gallons will be obtained from ethylene. The U.S. Department of Agriculture is sponsoring a million-dollar research programme to work out methods for producing alcohol cheaply and in sufficient quantity from sweet potatoes and other farm products. Canada is also preparing for a considerable increase in industrial alcohol production, including the use of cellulose sulphite liquor and surplus wheat as raw materials in addition to molasses.

Little has been published on new materials for alcohol manufacture, although an interesting suggestion is made by Nolte and

others (*Ind. Eng. Chem.*, 1942, 34, 670) that the waste products in citrus fruit drying and canning plants would furnish an economic raw material for the manufacture of ethyl alcohol, and fodder yeast, and methods of utilising the materials for these purposes are described. According to a note which appeared recently in *THE CHEMICAL AGE* (1942, 47, 509) research in Eire has shown that laminarin, a seaweed product, is a potential source of ethyl alcohol, yields of 13-16.9 gallons per ton of air-dried autumn weed having been obtained.

Raw Materials in America

There is reason to believe that the utilisation of the pentoses as sources of ethyl alcohol is being actively investigated in Germany, the U.S.A., and probably elsewhere, but there is little information on what measure of success has been achieved. The nature and quantities of all raw materials available to the U.S.A. for industrial alcohol manufacture are reviewed and discussed by O. W. Willcox (*Sugar*, 1942, 42, 37). An interesting summary of the research carried out recently and in progress in the U.S.A. for obtaining alcohol from farm products is given by W. D. Macfarlane (*Canad. Chem. and Proc. Ind.*, 1942, 26, 389). This includes the new saccharification process of the Century Distilling Co., the continuous fermentation process of the Seagram Distillery, Louisville, which seems of outstanding interest, and the work in progress at several American universities on the conversion of pentoses into ethyl alcohol by means of moulds or enzymes produced by fungi. The literature on methods for increasing alcohol yields and for improving efficiency in other directions in distillery practice has been very abundant and some of the articles seem worthy of further mention. In an article entitled "Getting More Alcohol from Present Facilities," G. T. Reich (*Chem. Met. Eng.*, 1942, 49, 129) has shown how existing facilities in many distilleries can be adapted to increase the production of ethyl alcohol without the use of strategic materials.

A stripping column of all-wood construction is one possibility cited. Other suggestions are equally challenging. It has been shown by Adams and others (*Chem. Met. Eng.*, 1942, 49, 158) that kiln-drying corn for distilleries definitely reduces the yield of alcohol and that it is advisable to ferment only naturally dried corn or corn dried at temperatures below 71° C. From a comparison of the effectiveness of various mould amylase preparations for saccharifying fermentation mash, Underkofler and others (*Proc. Iowa Acad. Sci.*, 1941, 48, 225; *Chem. Abs.*, 1942, 36, 1729) conclude that mould-amylase preparations are superior to malt in their ability to saccharify starch for fermentation.

An extensive review of recent methods for

increasing fermentation efficiency, including a reference to the Alzeola continuous fermentation process for molasses which has been established in Cuba and on which more detailed information is given in the October number of the *International Sugar Journal*, has been made by W. L. Owen (*Sugar*, 1942, 37, 3, 26). From the large number of articles that have appeared in *Spiritus Industrie*, *Brennerei Zeitung* and *Spirto Vodochnaya Prom.*, of which abstracts have become available in this country, it is evident that extensive investigations are also in progress both in Germany and in Russia on methods for improving distillery efficiency. From the scanty information available it does not appear that any results of outstanding importance have been obtained, although it seems probable that a useful method for the continuous fermentation of molasses has been worked out in Russia.

Ethyl Alcohol

There is little to be said about the numerous patent specifications published relating to ethyl alcohol, although the claims in two U.S. patents, Nos. 2,275,836 and 2,285,130, for the use of millet in place of or in addition to barley malt are interesting in view of the finding of Mordorets (*Spirto Vodochnaya Prom.*, 1939, 16, 35; *Chem. Abs.*, 1941, 35, 6056) that fermentation time is shortened and the yield of alcohol increased by using one part of millet malt to three parts of barley malt as saccharifying agent. Two Belgian patents for the production of ethyl alcohol from ethylene may also be referred to briefly.

Belgian Pat. No. 437,920 describes an absorption method for ethylene on which sulphuric acid is regenerated electrolytically, and Belgian Pat. No. 438,759 covers another absorption process in which ethyl-sulphuric acid is transformed into ether and sulphuric acid by the action of ethyl alcohol. The ether is then converted by steam into ethyl alcohol, the amount of ethyl alcohol produced being double that used. Little else of interest has been published on synthetic methods for obtaining ethyl alcohol. In marked contrast with the numerous publications relating to ethyl alcohol, with a few exceptions, the information published on the higher alcohols and indeed on all other solvent chemicals has been very scanty. Two causes have undoubtedly contributed to this deficiency—the need for maintaining secrecy in many cases to prevent useful information reaching the enemy and the shelving of investigations on compounds not required immediately for the war effort on account of more pressing problems. According to reports in American trade journals all isopropyl alcohols in the U.S.A. is to be used for acetone production, and some papers on the physical properties of the propyl

alcohols alone, or in mixed systems, have appeared in the *J. Amer. Chem. Soc.* and *Ind. Eng. Chem.* It is probable that all plants producing butyl alcohol by fermentation are working to full capacity as this fermentation furnishes acetone as well in approximately half of the amount of the butyl alcohol obtained.

It has been long known that the normal ratio between butyl alcohol and acetone produced could be altered to some extent by modifying fermentation conditions and, shortly before the war, claims were made that by the use of special organisms and for alterations of conditions of fermentation the proportion of acetone formed could be increased appreciably. Whether any attempt has been made to push up acetone production by these means and, if so, with what measure of success, has not been disclosed. In this connection reference may be made to U.S. Patent No. 2,200,126, which claims that the rates of neutral solvents can be controlled by the presence of a non-toxic nitrate in the fermenting mash. Underkofler and others (*Proc. Iowa Acad. Sci.*, 1941 48, 233; *Chem. Abs.*, 1942, 36, 1729) have shown that cassava is a suitable raw material for the butyl alcohol fermentation process if used together with corn or if small amounts of shrimp powder, corn gluten meal and/or soya-bean flour are added to the mash.

Riboflavin Production

The economic disposal of distillery slop has always been a major problem of the distillery industries, and observations made shortly before the war that under certain conditions the butyl-forming bacteria can synthesise riboflavin (vitamin B_2), led to investigations of methods whereby riboflavin production can be increased and the compound preserved during the concentration of the slop. From the evidence available it seems probable that concentrated butyl slop may be a valuable source of vitamin B_2 for poultry and animals. It may well be that further work will lead to methods of extracting the vitamin from the slop in a form suitable for human use. Before leaving the butyl alcohols a brief reference may be made to an article by Wegishi and Isobe (*Bull. Chem. Soc. Japan*, 1941, 16 278; *Brit. Chem. Abs.*, A II, 1942, 127) which describes methods for separating normal and isobutyl alcohols from hydrocarbons.

It seems that the shortage of chlorine has curtailed the manufacture of synthetic amyl alcohol from amylene in the U.S.A., and the manufacture of industrial ethyl alcohol from grain has reintroduced amyl alcohol and amyl acetate from fusel oil which had not appeared in the U.S. market for several years. A method for treating fusel oil is described in U.S. patent 2,294,346.

Judging from the meagre information given in American trade journals such as *The Oil*,

Paint and Drug Reporter, appreciable amounts of normal octyl alcohol are still being used in the U.S.A. There is little doubt that when normal times return, research will be resumed on the production and utilisation of aliphatic alcohols having six to ten or even more carbon atoms in the molecule, and on derivatives of these. An article by Emmet Reid and others (*J. Amer. Chem. Soc.*, 1941, 63, 3100) on the isomeric octanols has, therefore, more than academic interest. Emmet Reid and his co-workers have prepared four straight-chain and eighteen branched-chain octanols in large experimental quantities and have determined some of the physical and chemical properties of these alcohols.

There is very little indeed to report on the glycols. The U.S. Department of Agriculture has developed a new process for obtaining butylene glycol by the fermentation of corn and wheat, but no specific information on the nature of the method seems available up to date. It is reported also that a pilot plant for the same purpose has been constructed by the Seagram Distillery at Louisville. There has been the usual crop of patent specifications relating to glycols and their derivatives, but none of them seems of sufficient importance to justify a specific mention.

Glycerol

It is certain that much is being done to increase glycerol production by various methods and to find substitutes for glycerol, but there is no definite and reliable information on what is actually happening. All that has been published on fermentation glycerol is contained in a number of patent specifications in different countries, none of which presents any great interest. With regard to synthetic glycerol, it is reported in the *Manufacturing Chemist*, October, 1942, that the Shell Development Co. in the U.S.A. has offered to build a plant for the production of glycerol from propylene if U.S. Government facilities can be provided. A pilot plant is already working.

Reports have also reached this country that a process for the manufacture of glycerol from starch has been patented and developed in Hungary. This is said to involve the conversion of starch to glucose which is hydrogenated in the presence of a copper catalyst to form sorbitol. The latter is then hydrogenated further to yield glycerol and propylene glycol. With regard to glycerol substitutes it is stated by H. G. Speil (*Chem. Met. Eng.*, 1942, 49, Feb., 175) that sorbitol can replace glycerol with advantage in glue compositions and the like, and according to W. Friedrich (*Farben Ztg.*, 1940, 45, 673, *Paint Ind. Rev.*, 1942, 87, 102) other polyhydric alcohols such as pentaerythritol are as satisfactory as glycerol in the manufacture of ester gums, copal esters, and so forth.

Although the aldehydes themselves do not find much application as solvents, the ease with which they react to form acetals, keto alcohols and aldehydes having a greater number of carbon atoms in the molecule which can be hydrogenated to form alcohols, renders them of considerable importance in the organic chemical industry. The use of formals and acetals, particularly those derived from glycols and polyhydric alcohols, as solvents and plasticisers seems to be extending and keto alcohols obtained by the condensation of aldehydes and ketones with the esters derived from them are also attracting a considerable amount of attention, if the number of patents that have been taken out for their manufacture and application is any criterion. Although some of these specifications present features of secondary interest they are for the most part based on known methods of synthesis so that it is unnecessary to select any for specific mention.

Acrolein Condensation

A number of patent specifications have appeared claiming improved methods for condensing formaldehyde and acetaldehyde to form acrolein, an important intermediate in the synthesis of other organic chemicals, some of which have important applications in the solvents industry. The condensation itself is, of course, known, so all that can be protected is some modification or other of the operating conditions such as the use of special catalysts, control of the temperatures and pressures employed, and so on, and without more information than that available it is impossible to assess the real value of any of the methods proposed. Another process for obtaining acrolein, namely the hydration of propylene in presence of a mercury catalyst, has also been the subject of several patents, but the demand for propylene for conversion to isopropyl alcohol and acetone renders it unlikely that there will be a surplus anywhere for other purposes.

Among the ketones, increased production of acetone for war needs has been naturally the first consideration and for obvious reasons any new developments in this direction have been kept secret. Methyl ethyl ketone has found extensive application as a solvent for general purposes and owing to the increase in wood distilling it is probably available now in larger amounts than it was before the war. Some interesting investigations on the production of higher ketones by the condensation of alcohols with ketones have been described by Ipatieff and Haensch (*J. Org. Chem.*, 1942, 7, 189). Although methods of this nature have an academic rather than an industrial interest at the present time, they may assume more importance when conditions return to normal.

There seem to have been no new developments in the manufacture and use of esters and ethers as solvents and for the most part

the numerous patents relating to esters have dealt with esters of unsaturated alcohols, such as allyl alcohol and so on, and/or of unsaturated acids, such as maleic acid. It is probable that primarily these esters are intended for resin production by polymerisation and it is doubtful whether any of them will find much application in solvent compositions.

A brief reference to the aliphatic acids is not out of place here as they are essential intermediates in the manufacture of ester solvents, although there is nothing of outstanding interest to report. According to an article in a German technical journal, the production of butyric acid on a large scale by the fermentation of wood waste, leaves, and straw has been started in Germany, but for what purpose is not quite clear. A number of patent specifications have issued covering methods for the recovery and concentration of aliphatic acids, particularly from pyroligneous liquors, but for the most part they describe modifications of known methods and their value can only be assessed by the practical experience of those skilled in the art.

From notices that have appeared both in technical and in trade journals it is evident that interest in the nitroparaffins and their derivatives has not diminished and it may well be that these compounds play an important part in post-war development. The nitroparaffins are useful solvents for most types of synthetic rubber and have also been found to be of value in the production of lacquers based on synthetic resins and mixed cellulose esters. Nitropropane, a valuable solvent for cellulose acetate, seems particularly useful in this connection.

The Nitroalcohols

The nitroalcohols, which can be obtained by the condensation of nitroparaffins with aldehydes, are compounds which may eventually become of considerable importance industrially and the work of Sprang and Degering (*J. Amer. Chem. Soc.*, 1942, 64, 1063), who have prepared twenty nitroalcohols and measured some of the physical constants of these, is worth referring to in this connection. Mention may also be made of the synthesis by Cope and Hancock (*J. Amer. Chem. Soc.*, 1942, 64, 1503) of a related group of alcohols, the alkyl amino ethanols from ethanalamine, although compounds of this type are probably only of academic interest at the present time. Reference may also be made to one patent specification in this field, B. P. No. 544,158, which describes the production of nitro-olefines by the condensation of nitroparaffins with formaldehyde in the vapour phase in the presence of a dehydration catalyst.

There have been several interesting articles published on means for guarding against fire risks in plants manufacturing or using

inflammable solvents. J. Creevey (*THE CHEMICAL AGE*, 1942, 46, 203) has given a summary of the dangers connected with the use of inflammable liquids and some valuable suggestions for avoiding accidents. It is pointed out that the explosion of vapour/air mixtures may be set up by sparks as a result of friction and static electricity, or to non-enclosed electric plant, and that the surface area of liquids exposed to air should be as low as possible.

Safety Measures

Inert gas instead of air must be used in pipe lines for transferring liquids. Peroxide formation in ether may be prevented by storing over ferrous sulphate acidified by sulphuric acid and distilling from this before use. In an article entitled "Fire Protection Goes Automatic" (*Paint, Oil and Chem. Rev.*, 1942, 104, No. 8, 16), P. W. Eberhardt has given a description of built-in carbon dioxide extinguishing systems in plants using inflammable solvents. Carbon dioxide is stored in liquid form under pressure and is conveyed by pipes to hazard points where the gas is released automatically as required from nozzles by means of heat detectors. Reference can be made also to an interesting article by O. Griffin (*Ind. Eng. Chem.*, June, 1942), on guarding against fire hazards from inflammable liquids.

Nothing of outstanding importance has been published on the toxic properties of solvents and such information as has been available has consisted almost entirely of abstracts of articles in foreign journals. In the plasticiser field most of the published information consists of patent specifications claiming special compounds or groups of compounds as plasticisers, and it is impossible to judge in most cases whether the claims are based on actual working or whether they have been filed in the pious hope that the compounds covered will eventually prove of value for the purpose disclosed.

Among the many compounds mentioned specific reference may be made to the use of phthalic esters of nitroalcohols as plasticisers for cellulose esters and ethers, the use of methyl chlorostearates in conjunction with polyvinyl chloride and the use of thioglycols as plasticisers for vinyl compounds, as in these cases there is some external evidence that the claims made in the patents can be justified. The series of articles, of which some seem of definite interest, by A. Kraus on nitrocellulose solvents and plasticisers has continued in *Chem. Ztg.* and other German journals, and abstracts of them can be found in the British and American abstracting journals, particularly in those dealing with plastics and in the *Paint and Allied Industries Review*.

Fuel Economy in 1942—and After

A Campaign of Practical Education

THE fuel position in 1942 has been dominated by the coal situation. No industry has been free from fuel anxieties, and in some the shortage of fuel and the need for using apparently unsuitable fuels has caused considerable difficulties. It would serve no useful purpose now to hark back to the origins of this, nor to explain the mistakes of policy, dating as far back as Dunkirk, that gave rise to the coal shortage. What is of infinitely more purpose is to indicate the steps that have been taken to correct the situation and their effect on British industry. Inevitably, the war will leave its mark upon our attitude to fuel; the study of fuel technology, one of the most difficult of technical subjects, will become essential to every works.

The Rise of Fuel Technology

Great Britain was originally a cheap-coal country. Coal was plentiful, any type of coal required could be obtained, and there was no need for economies nor for advanced combustion technique. This was changed by the war of 1914-18. Britain became a dear-coal country, and manufacturers had to take cognisance of the price of their fuel. Moreover, during that war coal was scarce, and economies had to be made. Nothing approaching the present effort was then made, but the results were striking. The profession of fuel technology really dates from that time, and at least one fuel expert was to be found in every large works within a few years after 1918. The result was a striking decrease in the coal consumption. Electricity undertakings, for example, which in 1910 used $4\frac{1}{2}$ million tons of coal to produce some 2500 million units of current, in 1934 used only 11.4 million tons to produce about 16,000 million units. This industry by increased efficiency thus saved some 18 million tons of coal in 1934, as compared with the amount that would have been used in that year if efficiency had remained as in 1910. Similarly, the gas industry saved 8 million tons of coal and the iron and steel industry 6 million tons—a figure that has been materially improved since then. Thus these three industries together saved 32 million tons of coal, or some 12 to 15 per cent. of the total coal output of the country.

In this war, the efficient use of fuel has been imposed upon every works, and it seems likely that when industry returns to a peace basis, the demand for coal will be very materially reduced as compared with the pre-war demand. It is desirable that this should be so since our coal reserves are not unlimited. It has been shown that the best seams and the cheapest seams to work are

becoming exhausted, so that the price of coal is likely to rise still further. In other words, the manufacturer is likely to have additional incentive to continue to economise in coal after the war.

More coal is used for heating water than for all other purposes put together. The water may be for central heating, for domestic uses or, more generally, for steam generation. Most works have a boiler plant, and it is here that economies are chiefly sought. In order to obtain enough coal for present purposes, great efforts have been made to improve boiler efficiency. It has become recognised, however, that improvement in combustion efficiency, whether in boilers or furnaces, is only half the story, often less than half the story. It is recorded that a visitor to a works was shown with pride the wonderful boiler house, equipped with every instrument and device for control that could help in securing the last $\frac{1}{2}$ per cent. of efficiency. But on going outside the boiler house, he was unable to see his way for the volumes of steam that were escaping from every steam trap, exhaust pipe, and even from leaks in the pipes. More heat is lost through the wasteful use of steam than by inefficient boiler plants—bad though many of these are.

Fuel Economy Committee

The part played by the Government in promoting the efficient use of fuel is often not recognised, and any review of the year would be incomplete without some reference to what is being done if only so that industry should understand the facilities that are available. More than a year ago, the Mines Department of the Board of Trade, then in control of fuel, set up a Fuel Economy Committee. This committee was composed of a number of men of high technical standing, representing many industries and interests, under the chairmanship of Dr. E. S. Grumell, of I.C.I., who were charged with the task of saving as much industrial coal as possible by promoting the efficient use of fuel. Meetings at which engineers were asked to make suggestions for the saving of at least 10 million tons of coal annually were held all over the country and addressed by members of the committee. The campaign launched, the committee got to work on a positive policy. The account of what has been done will not be given here in chronological order, but an endeavour will be made to show the facilities that are available for instructing industry in how to economise coal. Most industries have their coal supplies restricted to a greater or lesser extent, and the only way to

maintain output is to make their coal go further.

Starting from the top downwards, attention has been focussed on the general management. It has been too often true that enlightened engineers have suggested improvements in fuel utilisation that have fallen on deaf ears in the past either because of complacency, because the savings did not seem worth while viewed against the background of total production costs, or because another official of the company concerned has resisted the change for reasons unconnected with fuel conservation. The fear that more efficient methods of utilising fuel would interfere with output or would cause a deterioration in the quality of the product has often been sufficient to condemn possible measures without trial. Every major fuel-using industry has been induced to form a fuel economy committee from among its own members. Most industries have trade associations and, wherever it is so, it is the trade association that has taken the initiative in this matter at the request of the Ministry's Fuel Economy Committee. These industry committees have for the most part appointed a fuel efficiency officer whose duties comprise the general oversight of the fuel policy of his industry. Since the committees consist of men from within the industry, the recommendations that they make are practical and will not adversely affect the operations of the industry.

Work of the Regional Committees

There is, of course, the difficulty that some firms are too scattered to take full advantage of their trade association committee. Other firms may belong to industries that have no trade committee; for these there is the Regional Committee. There are a number of Regional Committees covering the whole country, comprised of knowledgeable fuel experts, who have the general task of promoting industrial fuel economy in their districts. As an example of the sort of work these committees are doing, it may be mentioned that lists have been made of competent fuel engineers in an area who can be spared by their firms for a given number of days per month to visit other firms on request and advise on all matters relating to fuel utilisation. In effect, therefore, a consultant service has been provided free of charge. It is clear from these measures that the utilisation of fuel in every concern is, or can be, covered by a number of advisory bodies. The advice and assistance of these bodies is available to every firm in the country; sometimes there is machinery by which the Trade or Regional Committees can deduce which firms most need their help. Often the firms themselves must approach the appropriate body—either directly or through the Ministry—to ask for help. If full advantage is

taken of the facilities available, much may be accomplished.

Mankind is by nature careless, and much fuel can be saved through no greater efforts than by commonsense in turning off light and heat when it is not required, in adjusting the temperature of rooms to the weather, and in watching for the many minor sources of waste in the factory and office that look so trifling, but add up to so much. All firms have, therefore, been asked to appoint a fuel chaser, or Fuel Efficiency Officer, whose duty it shall be, in addition to his regular work, to be responsible for the effective use of whatever fuel is needed. On the lower plane the fuel chaser may be nothing more than an employee who sees that there is no obvious waste on the lines just indicated. On the higher plane, he may have control over the whole fuel economy of the factory; he will then require to be something of an expert in fuel utilisation. In large factories there may be a fuel department when the quantity of fuel used is very large, as in the iron and steel industry. Other works may find it preferable to appoint a fuel committee, sometimes comprising the foremen and one or two others. In smaller works, again, a single individual, sometimes the works manager himself, may be found best suited to the work.

Educational Campaign

This, however, is the appeal to the management—the men at the top. There yet remains the difficulty that, with the best will in the world, it is difficult to maintain efficiency if the basic knowledge is lacking. To remove this handicap a vast educational programme has been undertaken, the full extent of which is perhaps not yet revealed. Classes consisting of lecture-discussions for the engineers, fuel efficiency officers, and higher staff (including the managing director if he has time to attend) have been arranged all over the country, and literally many thousands of those for whom the courses were designed have attended. These courses consist of between 6 and 12 two-hour sessions held in the afternoons at over 70 centres, principally universities and technical colleges. The interest aroused has shown that industry generally has appreciated the advantage of these courses. It suggests quite forcibly that after the war most industries might with advantage extend the system to subjects other than fuel.

While a great deal can be obtained from these courses in the way of fundamental instruction and free discussion of difficulties, it remains true that the best practice in certain branches of fuel utilisation is not widely known. Sometimes, indeed, there is divergence between experts. A technical committee of the main Fuel Economy Committee is charged with the task of issuing Fuel Economy Bulletins to industry in

general which shall give the necessary information and call attention not only to ways in which fuel can be saved, but also to the best methods of carrying these suggestions into effect. These Bulletins are issued free by the Ministry of Fuel and Power, and it is understood that some 40,000 copies are now sent out. Chemical engineers, and others interested, who do not receive these bulletins would be well advised to make direct application for them. A comprehensive handbook on fuel utilisation is in course of preparation by the Education sub-committee, and is understood to be nearing completion. There has always been a difficulty in studying fuel technology in that no one book has contained a review of the whole subject. It is hoped that through collaboration between experts from many fields this handbook will be

sufficiently comprehensive and authoritative to remove this difficulty.

Positive measures of this broad nature, to direct attention to the most efficient methods of fuel utilisation, involving not only the direct combustion of coal, but the utilisation of steam heat, electricity, and gas, must have an immense cumulative effect. The campaign has been launched at a time when industry is confronted with the alternatives of reducing coal consumption or stopping the works. It is thus unlikely that appeals will fall upon deaf ears. That the effect will be permanent few can doubt. The high and rising cost of coal will make it imperative that what is done now shall not be undone after the war. It is likely that training in fuel utilisation will in future be part of the equipment of every works' engineer

NEW FIREPROOFER

Tests of a solution designed to make pilots' flying kit fireproof are being made by the Ministry of Aircraft Production. It is the result of two years' research work by a Croydon chemist, Mr. G. A. Petzold, and his son, Mr. G. E. C. Petzold. They became interested after a talk with Sir Hector Macneal, whose son-in-law in the R.A.F. was killed in an aeroplane that caught fire. Sir Hector offered to finance experiments to produce a flameproof material. The solution is not suitable for the ordinary R.A.F. uniform, but tests applied to gaberdine overalls, boots, earflaps, and gloves, are said to have had promising results.

NEW ZEALAND METALS

New Zealand import licensing regulations to be effective in 1943 have been amended in regard to several descriptions of metals and some other commodities. The former announcement included the transfer of metals in various forms from the Customs licensing category of "controlled" goods to administration by the Ministry of Supply, which would receive applications from importers, make allotments on the basis of imports by individual firms in 1939, and place a bulk order for approved requirements. It is now stated in an official memorandum, dated September 18, 1942, that *non-ferrous* metals will continue to be in the "control" category as at present, i.e., applications and licensing are to be dealt with by the Department of Customs on the merits of the individual case. The specified non-ferrous metals are: Copper, lead, tin and other metal (excluding aluminium) in billets, blooms, ingots or pigs; brass, copper, lead, tin and other metal (excluding aluminium) in bars or rods (except cast bars or rods of copper alloy); metal foil or leaf; metal hoop, plate or sheet, plain,

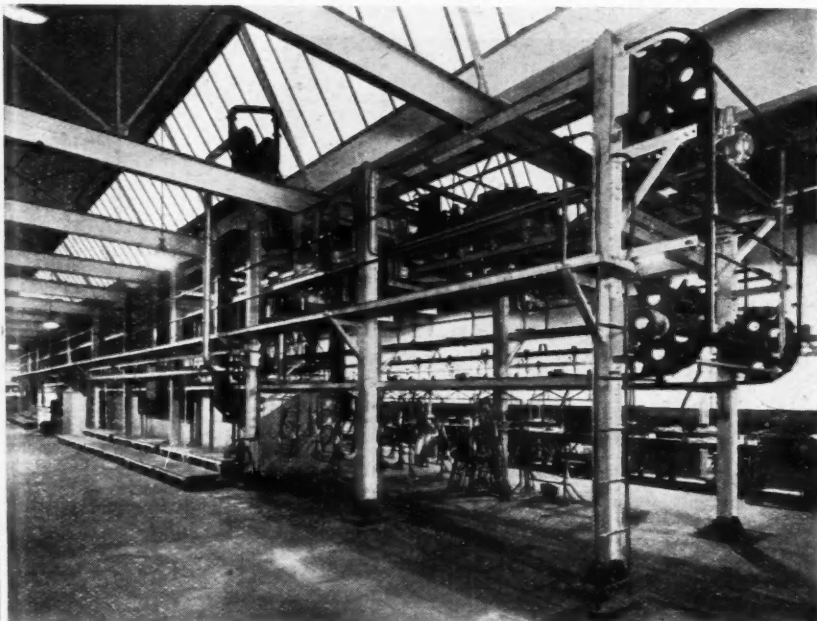
whether in the rough, polished, enamelled, galvanised, plated, tinned, or otherwise coated with metal (excluding lead sheet and aluminium); plain metal wire; barbed fencing-wire; wire cut to lengths, looped, twisted or plain, suited for baling and similar purposes; metal cordage; boiler tubes; pipes, piping, tubes and tubing (except lead). Precious metals, as well as ferrous metals, are excluded from this provision.

AUDLEY PRODUCTS

Products of The Audley Engineering Co., Ltd., continue to fill many of the needs of the chemical industry, and among the improvements which have taken place in the last twelve months to make them even more useful are the following. The "Audco" Lubricated Glass Valve, introduced some three years ago, has been modified in detail to make it more resistant to the effects of undue strain and shock. The plug head, previously in glass, and the most fragile part of the valve, is now made of metal, and the protective cage has been modified in detail to give even more protection to the valve proper. Stainless steel, used as a valve material, always has a tendency to seize and score. In the "Audco" Lubricated Valve this tendency was minimised by the film of lubricant between the seats, but not eliminated. For some five years the company has been coating the plug with a hard welded-on facing which *does* eliminate this difficulty, and the process is now so firmly established that valves of this type have become a standard catalogue item.

"Audcoloy," the corrosion-resistant alloy iron, has also continued to prove its value, and valves in this alloy have solved many difficulties in the handling of sulphuric acid, the higher concentrations of caustic soda, free fatty acids, tar acids, and many other chemicals.

THE YEAR'S PROGRESS IN PICTURES



Plating plant by the Electro-Chemical Engineering Co., Ltd. It is the only plant that plates bright nickel and chrome on steel in one uninterrupted process.



Three women chemists are seen at work here in the G.P.O. laboratory, testing substitutes for the manufacture of telephone instruments.



Vital engine parts, fit to stand up to modern warfare, made from a particular grade of steel scrap.

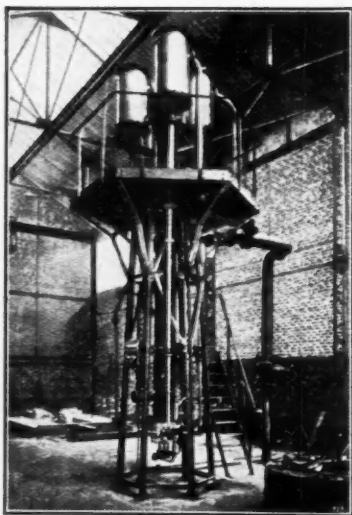
The Year's Progress in Pictures—II



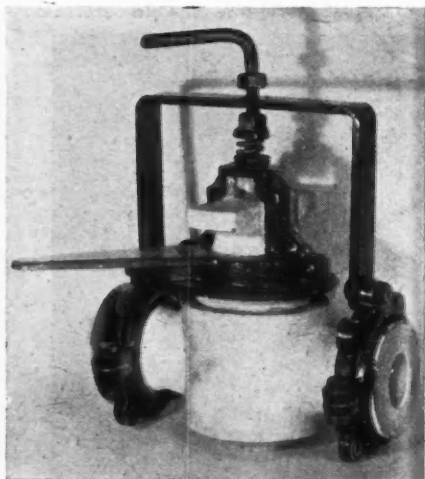
Government Departments and munition works laboratories made great demands on equipment manufacturers. Doulton and Co., Ltd., produced the laboratory porcelain shown above.



Spigot and socket joint—a device by Messrs. George Jennings (Lambeth) Ltd., for saving tin in soldering.



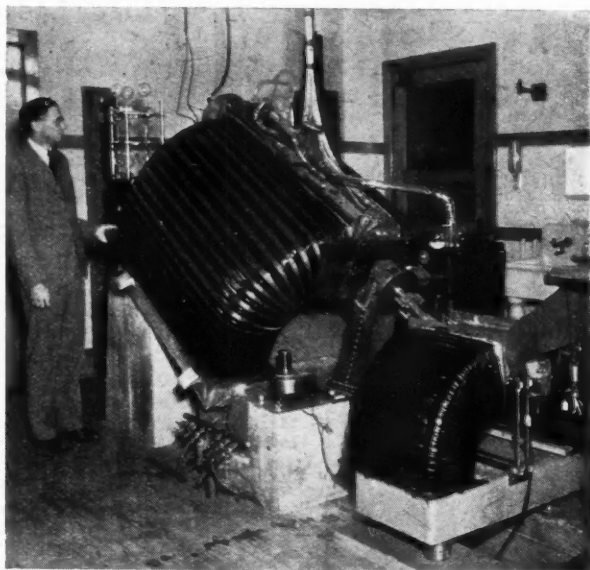
Triple circulation milk evaporator by the Kestner Evaporator & Engineering Co., Ltd.



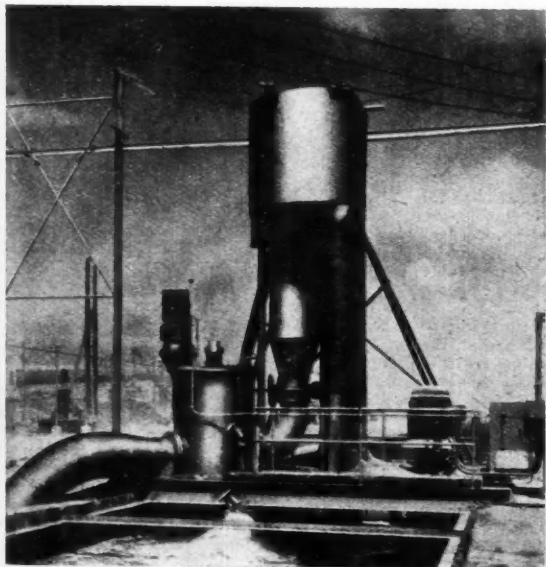
Acid-proof cock made by Doulton and Co., Ltd., in "Vitreon" ware, fitted with a special device to prevent the plug from sticking.

The Year's Progress in Pictures—III

Right: A mass spectrograph built by Dr. E. B. Jordan, at the University of Illinois, U.S.A., for measuring atomic energy.



Left: Centrifugal pump, part of the Freeport, Texas, plant of the Dow Chemical Company, for raising sea-water in a process for extracting magnesium from the sea. The pump delivers 10,000 gallons per minute.



News Events of 1942

JANUARY

THE death was announced of Professor Sebastian G. M. Ure, M.A., B.Sc., M.I.Chem.E., at the age of 60. Professor Ure was for a number of years Honorary Editor to the Institution of Chemical Engineers and, in 1937-38, served as Vice-President.

Mr. Geoffrey Heyworth was appointed chairman of Lever Brothers and Unilever, Ltd., in succession to the late Sir Francis D'Arcy Cooper.



Mr. G. Heyworth

An award of a C.B.E. to Mr. A. Wilson, director of I.C.I. (Explosives), Ltd., was announced in the New Year Honours List. Mr. G. H. Mackenzie, assistant production engineer to the same company, received an O.B.E.

FEBRUARY

THE Japanese advance along the whole length of the Malay Peninsula was followed by a spate of official orders controlling rubber and tin. Something like 80 per cent. of the world's rubber and 40 per cent. of the world's tin ore were produced in the Peninsula. The necessity for providing substitutes to make up for the inevitable shortage of these commodities was stressed.

It was announced that, in the January examinations, eleven candidates passed the examination in general chemistry for the Associateship of the Institute of Chemistry.

In the annual report of the Livesey Professor (Professor D. T. A. Townend, D.Sc., Ph.D., D.I.C.) to the Department of Coal, Gas and Fuel Industries with Metallurgy, University of Leeds, it was shown that investigation of the catalytic synthesis of methane had continued. It was believed that a simple and not unduly costly

method of removing organic sulphur compounds had been arrived at.

The death was announced of Dr. Thomas Herbert Norton, the famous American research chemist and chemical editor.

The Dutch were carrying out a "scorched earth" policy in the East Indies, destroying valuable oil works and other installations. One property alone was said to be valued at £18 million.

An Amendment to the Trading with the Enemy Order, which came into force on February 11, contained the names of about 600 persons or firms in neutral countries with whom trading was illegal. A feature was the large number of Japanese firms operating in South America.

Colonel H. S. Briggs, O.B.E., M.I. Mech.E., was nominated by the Board of Trade to be the Government representative on the executive committee of the British Standards Institution.

MARCH

SIR ALEXANDER KEOWN-BOYD, appointed chairman of the new Economic Advisory Committee, which was formed to advise on means for increasing war production in the Middle East, was before the war representative in Egypt of the Bradford Dyers' Association.



Mr. R. B. Pilcher.

A conference, attended by representatives of 60 British scientific organisations and learned societies, was held in the rooms of the Royal Society. It discussed the intensification of the exchange of technical and scientific information between the U.S.S.R. and Great Britain. Sir John Russell, adviser to the Soviet relations branch of the Ministry of Information, was in the chair.

Lieut.-Col. Sir John Henry Maitland Greenly was elected President of the Institute of Metals for 1942.

The death took place of Sir William Henry



Mr. E. G. Couzens.

Bragg, O.M., in London, at the age of 79. During his long life scientific honours were showered upon him. He experimented in radioactivity for many years, and was awarded, in 1915, the Nobel Prize for Physics. In 1935, he was elected President of the Royal Society and remained in that position for five years. In October, 1940, he was appointed to the war-time Scientific Advisory Committee under the chairmanship of Lord Hankey.

The twentieth annual corporate meeting of the Institution of Chemical Engineers was



Sir John Russell.

held in London, Mr. C. S. Garland, the president, being in the chair. Mr. S. Lall, High Commissioner for India spoke at the luncheon.

E

APRIL

LORD DUDLEY GORDON was elected President of the Federation of British Industries for the third successive year.

Sir Kingsley Wood, in his Budget, introduced proposals for additions to indirect taxation amounting to £150 million. Among industrialists there was a widespread feeling that Sir Kingsley had been too rigid in his maintenance of 100 per cent. Excess Profits Tax.

Mr. Fred Hoyland, A.M.I.Mech.E., retired from the position of superintendent of the chemical works of Newton Chambers and Co., Ltd., Thorncliffe, Sheffield, after nearly 53 years' service.



Dr. William Cullen.

The manufacture of synthetic rubber from petroleum was to be undertaken in Canada.

Mr. Richard B. Pilcher, Registrar and Secretary of the Institute of Chemistry, who had completed 50 years' service with the Institute, received presentations and congratulations from friends and associates in the chemical world.

Professor Jean Perrin, who died in New York, aged 71, after escaping from France to U.S.A., was Professor of Chemistry and Physics in the Paris Faculty of Science. He won the Nobel Prize in 1926 for his discoveries in connection with the discontinuous structure of matter.

MAY

At the 24th annual meeting of the London Section of the British Association of Chemists in London, the Chairman, Mr. W. C. Peck, gave an address which he described as of a new type for the Association. Instead of dealing with the preceding year's work, he gave members some thoughts on the chemist in his relation to the social structure of the time.

Dr. Arno Carl Fieldner, head of the Technologic Branch of the Bureau of Mines, Washington, U.S.A., was awarded the Melchett Medal for 1942.

The committee of the Plastics Group of the Society of Chemical Industry appointed Mr. E. G. Couzens as chairman. Total membership of the group was stated to be 382, the increase for the year being 69.

In the chairman's speech accompanying the annual report and accounts of Imperial Chemical Industries, Ltd., Lord McGowan said that the volume of output to meet demands had for a number of products touched new peaks. An exchange of technical information with other concerns was going on in the national interest.



Mr. C. F. Merrian.

JUNE

AT the request of the President of the Board of Trade, the Federation of British Industries compiled and published a report which it called "Reconstruction," a document which evoked great interest among industrialists and others.

Montecatini, Italy's chemical and metallurgical combine, reported for 1941 an intensification of operations. The number of factories rose to 225. The total number of workers increased from 78,500 to 81,000.

In view of the growing industrial importance of powder metallurgy, the American Society for Metals issued a glossary of some hundred terms used in connection with powdered metals.

Among the awards in the Birthday Honours List, were Knighthoods conferred on Mr. Robert Alexander Watson Watt, C.B., F.R.S., President of the Association of Scientific Workers, who played a leading part in the development of radiolocation;

and Mr. Holbrook Gaskell, director of I.C.I., and of Magnesium Elektron, Ltd.

Lord Glenconner joined the board of Imperial Chemical Industries, Ltd.

Systematic attacks on Germany's chemical industry were made by the R.A.F. A number of well-known chemical works were destroyed or damaged in the thousand-bomber raid on Cologne.

WITH the publication of the first July number, THE CHEMICAL AGE went into the form in which it is now seen. A reduction in the page size was dictated by the need for economy in paper.

Viscount Weir, director of I.C.I. and the International Nickel Co. of Canada, was appointed chairman of the Tank Board set up by the Ministry of Supply.

Sir Daniel Hall, K.C.B., D.Sc., F.R.S., died in London at the age of 78. He was one of the leading agricultural scientists in the country and the maker of the modern Rothamsted.

Meetings of Eire farmers were urging the Eire Government to take some action to get fertilisers imported. Saltpetre had been offered in the black market in Eire at £17 per ton, and sulphate of ammonia at £52 10s. per ton.

At the 61st annual meeting of the Society of Chemical Industry, held in London, Dr. William Cullen, LL.D., M.I.Chem.E., F.I.C., was re-elected President. Sir John Russell was presented with the Messel Medal.

AUGUST

A COMMITTEE composed of leading Canadian mining experts was announced as being engaged on the investigation of the possibilities of increasing Canada's output of zinc, copper, and lead. The development was expected to have far-reaching effects.

A campaign for the salvage of ten million old gramophone records was started by the British Legion, in order to make up for the scarcity of imported shellac.

SEPTEMBER

THE Minister of Production appointed to his staff several full-time scientific advisers. Among these was Dr. I. M. Heilbron, Professor of Organic Chemistry, Imperial College of Science and Technology. Mr. W. A. Stanier, chief mechanical engineer of the London Midland and Scottish Railway; and Dr. T. R. Merton, treasurer of the Royal Society, were also appointed.

Far-reaching economies in paper usage were effected by a new Ministry of Supply Control of Paper Order.

Negotiations were reported to be in progress between the British and Turkish Governments for a renewal of the agreement concerning British purchases of chrome from Turkey, in the face of German attempts to secure a large supply of this material.

Laval was stated to have supplied lists of names of French chemists to Hitler, the owners of them being ordered to Germany in batches.

Dr. George Gerald Henderson, D.Sc., F.R.S., Emeritus Professor (1919-37) of Chemistry at Glasgow University, died at the age of 80. Dr. Henderson was president of the Chemistry Section of the British Association in 1916 and had been president of the Chemical Society, the Institute of Chemistry, and the Society of Chemical Industry.

OCTOBER

THE monthly bulletin of the British Ministry of Labour and National Service told of the important part women were playing in the metallurgical industry. In a new Ordnance factory, for instance, women provided 80 per cent. of the labour force.

Sir Robert Dale, President of the Royal Society, accepted the Directorship of the Laboratories of the Royal Institution, with the Fullin Professorship, in succession to the late Sir William Bragg. Sir Henry expressed the wish that his appointment should be limited to a period of three years.

The Melchett Medal for 1942 was received on behalf of Dr. Arno Carl Fieldner by Mr. Mulford Colebrook, of the U.S. Embassy in London. The Melchett Lecture, prepared by Dr. Fieldner, was delivered by means of a talking film.

At the 26th annual general meeting of the Association of British Chemical Manufacturers, held in London, the chairman, Mr. C. F. Merriam spoke on post-war planning.

Professor Samuel Sugden, F.R.S., D.Sc. (Lond.), A.R.C.S., A.I.C., was selected to succeed Dr. Godfrey Rotter as Director of Explosives Research at the Royal Arsenal, Woolwich.

Mr. Horace Broadbent, chairman of Thomas Broadbent and Sons, Ltd., Huddersfield, died at the age of 79. He was one of the country's leading authorities on centrifugal machines.

NOVEMBER

LORD MCGOWAN spoke of post-war developments in Scotland. His company was considerably extending its plant for the

production of pharmaceuticals. He stressed the possibilities of the development of hydro-electric power.

Professor John Norman Collie, D.Sc., LL.D., F.R.S., F.R.S.E., died in Skye, aged 83. He was Emeritus Professor of Organic Chemistry at University College, London.

In the list of awards of the Royal Society one of the Royal Medals went to Professor W. N. Haworth, F.R.S., for his contributions to organic chemistry.



Lord McGowan

A Joint Council of Professional Scientists, representing more than 10,000 qualified scientists, was set up under the chairmanship of Sir Robert Pickard, F.R.S., by the Institutes of Chemistry and Physics, in association with other scientists, in order to voice the collective opinion of those represented on matters of public interest.

Mr. John Hargreaves, F.C.S., F.I.C., one of the most famous figures in industrial chemistry for many years, died in Widnes, Lancashire, at the age of 90.

DECEMBER

SIR RICHARD GREGORY, President of the British Association, presided at a conference in London of scientific workers from countries menaced or oppressed by Nazi Germany and her allies. The conference pledged itself to intensify its efforts against the enemy.

Mr. Henry Jeffries Pooley, M.Inst. Chem.E., died at his home in Finchley, London, at the age of 65. He was a well-known figure in the chemical industry of this country and many other parts of the world, and was for more than thirteen years general secretary of the Society of Chemical Industry.

Plastic Carrying Buckets

Substitute for Rubber and Ebonite

OF the many present problems in the chemical, tanning and electro-plating industries not the least is the increasing difficulty of obtaining rubber or ebonite buckets for the handling of acids and other corrosive liquids. The use of the familiar rubber bucket has become somewhat of a habit in these industries, and with the imperative necessity of conserving supplies of rubber wherever possible, some chemists and works managers are wondering what substitute they can employ. There is, however, a well-tried synthetic plastic bucket available which, it is claimed, will meet many of their needs. This is the Lorival Acid Bucket, made from a cast phenolic resin which has been found from many years' experience to be unaffected by many industrial chemicals.

Not only can this bucket be used for many of the more common acids, such as sulphuric and hydrochloric at ordinary temperatures, but in many cases it remains unaffected by these liquids at temperatures up to 100° C. It should, therefore, fulfil the requirements in many establishments where such acids have to be handled in the course of manufacturing processes. This type of bucket is already well established in many of the leading chemical-producing firms and in the applied chemical industries such as tanning, artificial silk manufacture, and the chlorinating industry.

For Organic Solvents

While it cannot be recommended for the carrying of caustic solutions, the Lorival Bucket can be used in many instances where ebonite would be unsuitable, and establishments handling organic solvents such as 90's benzol, naphtha, carbon tetrachloride, and acetone can use this container with confidence, the makers state. It has been subjected to lengthy tests which go to show that although with some chemical agents a noticeable discoloration of the plastic material takes place, this does not indicate that deterioration of the surface of the bucket or contamination of the contents has occurred. The Lorival Bucket can be readily supplied in the 2-gallon size at 34s., or, if desired, with a convenient carrying handle at 38s. 6d. Full technical data are available on application to the manufacturers, United Ebonite and Lorival, Ltd., Little Lever, Bolton, Lancs, who will be pleased to supply any further information which chemical engineers may require.

The wholesale price of pool paraffin has been increased by 1d. a gallon.

Chemical Engineers

Institution Annual Meeting Announced

IT is announced that the 21st annual corporate meeting of the Institution of Chemical Engineers will be held at the Connaught Rooms, Great Queen Street, London, W.C.2, on April 2, at 11 a.m. Several vacancies among the officers and members of Council will fall to be filled by selection, and the nominations of the Council for these forthcoming vacancies are as follows: *President*: F. A. Greene; *Vice-Presidents*: H. Beaver, H. J. Bush, H. Griffiths, and E. W. Smith, C.B.E.; *Joint Hon. Secretaries*: A. J. V. Underwood, M. B. Donald; *Hon. Treasurer*: H. W. Cremer; *Members of Council*: W. M. Cumming, F. H. Garner, G. W. Himus, and J. W. McDavid; *Associate-Member of Council*: J. P. Baxter.

Nominations from members, made in accordance with the Articles of the Institution, must reach the registered office of the Institution not later than February 19. Should there be no members' nominations the nominees of the Council will be declared elected at the meeting. The business meeting will be followed by the address of the President, at 12 noon; luncheon will be served at 12.30 for 1 p.m. There will be no afternoon or evening session.

News of members and associated members in the Quarterly Bulletin of the Institution includes the announcement that Dr. J. C. Swallow is with the research department of I.C.I. (Plastics), Ltd.; Mr. D. C. Brookes is now a director of the Aluminium Corporation, Ltd., the Northern Aluminium Co., Ltd., and other aluminium companies, his main activity continuing to be with the raw material division of Northern Aluminium; Mr. J. O. S. Macdonald is senior plant manager with Magnesium Elektron, Ltd.; Mr. W. T. Thomas is researching in chemical engineering with Murex, Ltd.; and Mr. John Myles has joined the Bristol Yeast Factory of the Distillers Co., Ltd., as assistant works manager.

CANADA'S MINERALS

The mineral production of Canada in 1942 reached the record value of \$564,200,000, according to an estimate cabled to the High Commissioner of Canada in London. This represents an increase of \$4,000,000 over 1941, in spite of the \$20,000,000 drop in gold production. Notable features in the 1942 report are the increased output of tungsten, the production of metallic magnesium from dolomite, a considerable rise in the amount of tin available, and the important development of Canadian mercury. Figures for strategic base metals are not now published separately, but the aggregate shows a rise in value of \$3,238,000, of which \$1,500,000 is accounted for by copper and nickel together.

Personal Notes

MR. H. WHITTAKER has been elected a director of the Cape Asbestos Company, Ltd.

MR. A. F. THORN, of Glais, Swansea Valley, has retired after 39 years' service at the Mond Nickel Works, Clydach. For 24 years he was engineering foreman.

MR. KENNETH LAMPSON was appointed Assistant Controller, Iron and Steel Supplies Department, Iron and Steel Control, Ministry of Supply, on January 1.

At the request of the Ministry of Supply, SIR CHARLES WRIGHT has been appointed Acting Controller of Iron and Steel in place of SIR JOHN DUNCANSON who has undergone an operation.

MR. H. A. CURRAN, A.I.C., A.R.C.Sc.I., A.I.R.I., is retiring from the Technical Directorship of Hubron Rubber Chemicals, Ltd., Manchester. His services will be retained as technical consultant.

MR. HAROLD WHEELER, a Pittsburgh mining expert, arrived at Doncaster last week to begin a ten-day tour of the collieries of the area. He will advise the Ministry of Fuel on the type of American coal-cutting machinery which could be introduced with a view to an increase in output.

MR. F. S. TOWLE has relinquished his appointment as Director for Iron and Steel Scrap Supplies. He will be succeeded by MR. H. W. SECKER, hitherto Area Representative in Sheffield. MR. J. MCCALLUM succeeds MR. A. J. WAINFORD as Area Representative for the North-East Coast.

DR. E. HEYMANN, who has been senior lecturer in physical chemistry at Melbourne University since 1935, has been awarded the H. G. Smith Memorial Medal by the Australian Chemical Institute in recognition of his signal contributions to chemical science, especially in the field of colloid chemistry and the physical chemistry of molten salts.

MR. ALEXANDER GEORGE GRANT, M.Sc., M.Inst.Chem.E., A.M.Inst. Gas E., for the past four years general manager of The Whessoe Foundry and Engineering Company, Ltd., Darlington, has now joined the board of that company. Mr. Grant has been associated with the company since 1930 and has taken a leading part in recent technical developments.

DR. HENRY GEORGE DENHAM, Chairman of the Council of Scientific and Industrial Research and Rector of Canterbury University College, New Zealand, was invested, on January 4, with honorary membership of the Society of Chemical Industry, in appreciation of his activities as a research worker in the field of inorganic chemistry. The High Commissioner for New Zealand (Mr. W. J. Jordan), attended the function and

accepted the scroll on behalf of Dr. Denham.

New Year Honours

An interesting feature of the New Year Honours list is the number of awards that have gone to the scientists and scientific industrialists, a reflection of the greater recognition now being given to the valuable contribution they are making to the national effort.

Knights Bachelor

MR. ARTHUR BENEDICT WINDER is director and general manager of the English Steel Corporation, Ltd. He is also on the board of Firth-Vickers Stainless Steels, Ltd., High Speed Steel Alloys, Ltd., and the Oughtibridge Silica Firebrick Co., Ltd.

MR. GEORGE H. NELSON, chairman and managing director of the English Electric Co., Ltd., receives the award for his services to the Ministry of Aircraft Production and the Ministry of Supply. He is on the board of several electrical equipment concerns, including the Micanite and Insulators Co., Ltd.

PROFESSOR ALFRED CHARLES GLYN EGERTON, who has held the Chair of Chemical Technology at the Imperial College of Science and Technology since 1936. Professor Egerton is Joint Secretary of the Royal Society. He was, for a period, a Member of the Advisory Council of the D.S.I.R.

MR. WILLIAM MURRAY MORRISON, M.Inst.C.E., deputy-chairman and managing director of the British Aluminium Co., Ltd. Mr. Morrison is also a director of other companies concerned with the development of light metals on both the raw materials and the manufacturing sides. He is an original Member and Fellow of the Institute of Metals and has been Vice-President for the last two years.

Other Awards

Other awards include the G.B.E. to SIR HENRY HALETT DALE, C.B.E., lately Director of the National Institute for Medical Research. Sir Henry is President of the Royal Society and became a Member of the Scientific Advisory Committee to the War Cabinet in 1940. MR. R. A. MACGREGOR, a chemical metallurgist in the Department of Supply, Calcutta, receives the C.I.E.; MR. M. GREENWOOD, specialist in chemistry in the Department of Agriculture, Gold Coast, is awarded the M.B.E.; MR. D. YATES, a metallurgist of South Australia, receives the C.M.G.

The second part of the New Year honours list includes the following names of chemical interest. Awarded the O.B.E.: C. DAXNATT, D.Sc., M.I.E.E., head of a section of the Research Department, Metropolitan-Vickers Electrical Co., Ltd.; O. C. ELLING-

TON, Principal Chemist, Chemical Inspection Department, Ministry of Supply; H. W. FORSHAW, Principal Scientific Officer, Air Defence Research and Development Establishment, Ministry of Supply; S. J. JOHNSTONE, F.I.C., Principal, Mineral Resources Department, Imperial Institute, a general Member of Council of the Institute of Chemistry and Vice-Chairman of its London section; GEORGE EVETTS, chairman of the Benzol Advisory Committee of the Ministry of Fuel; B. B. MURDOCH, A.I.C., Assistant Director of Materials Production, Ministry of Aircraft Production. G. W. DANIELS, Chief Engineer, Distillers Co., Ltd.; and E. C. S. MEGAW, Scientific Officer, Research Laboratories G.E.C., Ltd., receive the M.B.E. (Civil Division). The B.E.M. (Civil Division) is awarded to S. H. JELFFS, Foreman, I.C.I. (Metals), Ltd., and S. H. OFFER, Supervisor (Workshops), Chemical Defence Experimental Station, Ministry of Supply.

Obituary

MR. ALBERT G. BURNELL, chief analytical chemist to the Great Southern Railway Company of Ireland, has died in Dublin. Mr. Burnell took up his appointment about 27 years ago, after serving as assistant analytical chemist to the G.W.R. at Swindon. Recently, he had been associated with the work of the Eire Emergency Research Bureau on producer-gas problems.

MR. FRANK WILLIAM HARBORD, C.B.E., the distinguished steel metallurgist, died on December 27 at the age of 82. He was known to two generations of metallurgists as a leading authority on the acid process and the basic Bessemer process, and his "Metallurgy of Steel," published in 1904, remains a standard work. A native of Norfolk, he was educated at the Royal School of Mines, where he won the Bessemer Medal in 1882. After serving with various steel companies in the Midlands (where he was largely responsible for the introduction of the Bessemer process), he acted as metallurgical chemist to the Royal Indian Engineering College, Coopers Hill, from 1892 to 1905. He then went into private practice, and at his death was senior partner in the firm of Riley, Harbord and Law. He had been president of the Institution of Mining and Metallurgy and of the Iron and Steel Institute, and in 1916 won the Bessemer Medal of the latter society.

New Control Orders

Export Control Consolidated

THE Board of Trade has issued the Export of Goods (Control) (No. 45) Order, 1942 (S.R. & O., 1942, No. 2660), the chief effect of which is to consolidate

previous Orders. The new Order comes into force on January 15, and sets out the position with reference to Export Licensing control at that date. Goods included in the Schedule to this Order will require a licence for export to any destination, but under the terms of a special provision, certain machine tools may continue to be exported without licence to British Empire destinations. The provisions under which glassware could be exported without licence are withdrawn.

The following are the principal alterations: (i) Eritrea, Ethiopia, Iceland, Italian Somaliland, Northern Rhodesia, Nyasaland, Portuguese East Africa and Portuguese West Africa have been added to the list of destinations to which the export of all goods is prohibited without licence.

(ii) Classes of goods affected by the changes and to which control has been extended include, under the head of chemicals: Acetals; amyl acetate; amyl alcohol; calcium acetate; diacetone alcohol; ethyl acetate; ethylene oxide and diethylene oxide; furfural; fusel oil; guanidine nitrate; hexyl alcohol; isopropyl acetate; melamine; methyl acetate; methyl ethyl ketone; methyl isobutyl ketone; salt; sulphite lye (sulphite cellulose residue); and ultramarine blue.

Certain metal manufactures, mainly of a domestic or decorative nature; vulcanised fibre, in the form of bars, blocks, rods, tubes, sheets or strip; adhesive tapes; insertion sheet and strip; and jointings and packings, made wholly or partly of balata, gutta-percha, rubber latex, rubber or synthetic rubber; and crayons, chalks, and pastels, made wholly or partly of wax, are also included.

Magnesium

The Control of Magnesium (No. 4) Order, 1942 (S.R. & O., 1942, No. 2637), revokes the three earlier Orders, but confirms that magnesium and its alloys shall not be bought, sold or used except under licence. Existing licences do not require to be renewed. The maximum price of magnesium powder to any specification is fixed at 4s. per lb.

Quinine

Under an order which came into force on January 5, no person may acquire, treat, use or consume supplies of cinchona, cinchona products, and synthetic substitutes, except under licence from the Ministry of Supply. The order prohibits the prescribing of quinine and its salts and any other controlled material except as an anti-malarial drug. Merchant vessels can still obtain supplies. All persons holding stocks equivalent to more than 16 oz. of quinine must notify the Director of Medical Supplies, Portland House, Tothill Street, S.W.1, before January 23, of the quantities they hold and the places where it is stored.

The Chemical Industry and the War

(Continued from page 48.)

As is seen, it comprises the following elements: (1) cast-iron sectional plated gas liquor feed tank; (2) steel storage tank for concentrated gas liquor; (3) ring-packed still; (4) water scrubber with superposed lagged gas liquor-fed scrubber; (5) behind is the primary and secondary cooler with bleeder pipe to a gas liquor scrubber; (6) scrubber for concentrated gas liquor storage boiler; (7) instrument panel in connection with Arca controls; (8) pump for concentrated gas liquor; (9) hydraulic change valve for oxide of iron purifiers; (10) two effluent cooling tanks; (11) flow meter for effluent liquor and (12) stand-pipe for loading concentrated gas liquor. These plants are producing regularly concentrated gas liquor of 18-20 per cent. ammonia weight, and provided the Arca controls are given reasonable attention, they can operate practically without labour.

The manufacture of ammonium sulphate from ammonium carbonate and calcium sulphate is attended by certain disabilities, particularly the relative slowness of certain operations and the high cost of evaporation. These difficulties can be largely overcome, according to G. Claude,²⁰ by adding ammonia to the solution of ammonium sulphate, and thus precipitating 75 per cent. of the salt. The ammonia can then be dissociated from the mother liquor and used again. A further suggestion to improve the economics of the process is that the calcium carbonate formed should not be washed to remove ammonium sulphate, but should be dried and used as a fertiliser, being particularly valuable in cases where calcium carbonate is deficient in the soil.

Another patent²⁰ has appeared, dealing with the control of crystal size in the production of ammonium sulphate. Apart from maintaining the free acidity at 3.5 per cent. H_2SO_4 , the authors (R. H. Roberts and I.C.I., Ltd.) propose to add ferric sulphate and sodium thiosulphate, with or without traces of copper sulphate and magnesium sulphate.

Alkali Industry

The production of alkali in this country since 1939 has increased. Soda ash is still manufactured predominantly by the ammonia-soda process, which is well-

established, and to which improvements of technique are introduced from time to time. Whether the demand for chlorine has adversely influenced the production of soda ash in this country is doubted. It can only be affected unfavourably, to the extent to which less soda ash is being causticised. As far as one can gather, the tendency is to discard the weak electrolytic caustic soda solution where chlorine in large quantity is the major requirement for the magnesium industry. To-day more soda ash is being used in the textile and glass industries.

A curious law case has been heard in the United States, having relation to the pre-treatment of oyster shells from the Calcasieu Lake, used for the production of lime, and CO_2 for carbonating purposes. The Mathieson Alkali Works, of Lake Charles, La., against whom the action was taken, upheld their case that the oyster shells were not crushed, which constituted the patent of another company, but only washed prior to introduction to rotary calciners.

Phosphatic Fertilisers

As the war proceeds, and fresh territories are invaded, new problems necessarily arise—not least the supply of raw materials for given industries. With the occupation of North Africa by the Germans and Italians, this country was deprived of its usual supplies of Algerian and Tunisian phosphates. For two years Florida phosphates and "concentrates" have been purchased for the manufacture of calcium superphosphate. The "concentrates" are not too suitable for treatment in the Broadfield den, many of which have been erected during the last few years. The "concentrates" in question are more moist than normal phosphate rock, and contain more fluorides. Evolution of noxious gases occurs at an unusual part of the den, and indeed, there has been discharge of partly-treated phosphate at this particular point, causing not a little inconvenience and nuisance. True, improvised devices have been adopted for removing the noxious gases by fan draught, but it seems clear that the Broadfield den is not suitable for all classes of phosphate. For this reason the Sturtevant-Moritz den is deservedly gaining favour.

Interest has been evoked in the new unit operation of granulation by the fer-

tiliser industry. Those accustomed to manufacture organic manures, and indeed those who have hitherto depended on very fine grinding for the preparation of compound fertilisers, now apparently see the "red light," and are rightly concerned lest granular fertilisers may dislodge their products. In an article on "Granulation and the Fertiliser Industry," by D. P. Hopkins, B.Sc., A.I.C.,²¹ misgiving is expressed and many pertinent considerations are raised. It seems apposite, in view of the article in question, to re-state the position regarding granular fertilisers. Knowledge of the application of fertilisers is a subject about which there is only limited information, but Nordengren and Lebrecke²² have made clear what are the merits of granular fertilisers, and from their findings it is clear that the primary justification for granulation resides in the farmer's ability to get double the fertility from fertilisers so prepared.

The possibility of applying any fertiliser in drills is unsatisfactory with a mixture of fertiliser constituents consisting of powdery materials. Powders are usually dusty when dry, and sticky when damp, and crystalline or granular particles of an appreciable size obviously flow more readily than powders. The possibility of applying any fertiliser in drills is represented by its ability for uniform and regular distribution. That a granular material is ideal for distribution in drills cannot be gainsaid. Here is a second justification for granulation. Mr. Hopkins suggests, in his article, that "new drills may out-mode granulation." Surely this is a sophism. One does not manufacture fertilisers to suit drills. Obviously, drills must suit the fertilisers, and fertilisers must be the best for application to, and efficient utilisation by, the soil.

Trace Elements

If organic fertilisers cannot be rendered granular, then this is a demerit of such fertilisers. But there is reason to know that granulation is possible with organics as a component of a complete fertiliser. Further, there should be no difficulty in introducing trace elements to any complete fertiliser to be granulated, or in modifying the constitution or proportions of a complete fertiliser to be granulated. Granulation need not, therefore, limit mass production to one or two

standard fertilisers. There should be as many standards as soil analyses dictate as prudent, essential and economical. If the farmer gets double the service from granular fertilisers, he can clearly afford to pay for the cost of granulation. From a manufacturing viewpoint, conditioning is now undertaken by most factories, and this cost (certainly not negligible), may approach the cost of granulation. Plant for the granulation of fertilisers is being fabricated by at least one important firm in this country, and there is evidence that this new development will extend and ultimately become almost universal.

This country has been fortunate in securing supplies of muriate of potash from Russia. The material usually contains 60 per cent., KCl, and is not crystalline, but in the form of a powder, suggesting that it has been precipitated from a supersaturated solution.

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- 18 *Chem. Tr. J.*, 1942, **111**, 499.
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F.B.I. Research Committee A Representative Body

THE committee formed by the F.B.I. to consider industrial research problems (see p. 34) is broadly representative of science and industry. It is made up as under:

Dr. S. B. Bagley (Bagley and Co.); Mr. W. Bond (Dunlop Rubber); Mr. T. A. Fairclough (Tootal, Broadhurst, Lee and Co.); Dr. W. H. Glover (Courtauld's); Dr. W. H. Hatfield (Thos. Firth and John Brown); Lord Melchett (I.C.I.); Sir Felix Pole (Associated Electrical Industries); Mr. S. K. Thornley (Thornley and Knight); Mr. H. Whithenshaw (Penketh Tanning Co.); Dr. W. P. Griffiths (Mond Nickel); Mr. A. L. Hetherington (Department of Scientific Research); Dr. C. C. Paterson (General Electric Co.); Dr. W. T. K. Brauholtz (Institute of Gas Engineers).

General News

Soaps and soap preparations listed in the British Pharmacopoeia or the British Pharmaceutical Codex, and certain medicated soaps, are now exempt from soap rationing.

More than one industrial consumer has expressed to the Regional Fuel Controllers the opinion that a Fuel Economy Association after the war would be highly desirable and prove a profitable venture for industrialists.

The Ministry of Supply is reported to have come to an arrangement with Wheal Reeth Tin Company, Cornwall, for renting the company's milling plant for the treatment of neighbouring dumps.

The Scottish National Party has expressed disapproval of the report on hydro-electric development in the Highlands on the ground that the electro-chemical and electro-metalurgical industries are not the most suitable for the area under discussion.

The Minister of Fuel and Power has sent a letter to 30,000 factory managements throughout the country asking them to appoint a responsible member of the staff as Fuel Watcher. The Ministry is providing an official badge.

A War Emergency Standard for black paint (tar base) for use on iron and steel (B.S. 1070-1942) has been issued by the British Standards Institution. Copies (1s. post free) can be obtained from the B.S.I., 28 Victoria Street, London, S.W.1.

Some idea of the remarkable progress of the Red Cross Penny-a-Week Fund may be gained by the fact that more than £2,500,000 was contributed during 1942, and that the total amount so far raised in pennies during three years of war is approximately £1,312,000.

In a New Year message, Lord Dudley Gordon, president of the Federation of Sir Thomas Industries, said that in 1942 Britain achieved an output in proportion to the population greater than that of any other country. "Peace, we know," he continued, "will bring its problems, but if we can face them with the energy and spirit that governs in these stern years, the problems will not prove insuperable."

A strong committee of geologists and mineralogists, under the chairmanship of Sir Thomas Holland, which has been inquiring into the available sources of information concerning the world's mineral and metal resources (other than coal and petroleum), is drafting a report in which data and proposals will be submitted to the Council of the British Association on the problem of establishing international agreement and organisation in connection with natural resources.

From Week to Week

The designation of the Director of Producer Gas Vehicles (Sir Alfred Faulkner), who has been allotted additional duties in connection with the development of fuels, other than petroleum, for road transport, has been changed to Director of Alternative Motor Fuels.

Foreign News

The Office of Price Administration, Washington, is expected to raise the ceiling price of heavy California crude oil within the next few days in order to increase production.

Australia is rapidly becoming self-sufficient in mica production, and in 1943 the work now undertaken will supply all requirements, according to Mr. John Beasley, Commonwealth Minister of Supply.

Faser Industrie G.m.b.H., Coburg, has been established for the production of textile glass fibres with a capital of RM. 100,000. The company will control similar works in various occupied countries.

More than half-a-dozen of the U.S. Steel Corporation's new producing or finishing plants will be operating during the first half of 1943, it is announced by Mr. Irving Olds, chairman of the board.

The Rumianca Company at Turin has started the production of insecticides on a large scale to replace copper sulphate. Two new compounds, "Cupramina" and "Ramital," have proved good substitutes.

German margarine works have been amalgamated in a new concern, the "Vereinigte Oel und Fettwerke A.G." with a capital of RM. 41.87 million. More than 20 margarine works are now combined in the new company.

Difficulty of obtaining supplies of graphite from overseas has drawn attention to the possibility of satisfying Australian demands from within the Commonwealth. Deposits of flake graphite are known to exist on Eyre Peninsula, S. Australia, from one of which there has been some production in the past, but on the others little has been done in the way of exploratory work.

In investigations on refractories in open-hearth furnaces under severe service conditions and high throughputs, Mr. R. L. Pewsner, a Russian investigator, has observed that four zones are produced in silica test blocks, the cristobalite zone being particularly pronounced. This zone is an average of 55 mm. thick and, in a few instances, 130 mm. thick. Petrographic examination revealed weak tridymitisation in all zones, accounting for the heavy slag attack.

New soda-works equipment, originally ordered in Germany for Irak, will be used for the establishment of a new soda factory in Hungary to be erected near Budapest.

Favourable developments in the Hungarian tanning situation are reported in the local Press. In spite of the falling off in Croatian supplies, Hungarian production is covered by the home production of oak bark, fir bark and substitutes produced from cellulose. Locally produced tanning materials are valued with some 12 million pengő yearly.

The shortage of vanadium, due to increased demands and shipping difficulties, has resulted in increased efforts to recover more of this metal in Canada. On both coasts the ash residues from oil burning ships are being collected so that the vanadium content may be obtained. The Newfoundland iron ores yield small quantities of vanadium which are concentrated in the open earth slags.

A plastic material perfected by the Celanese Corporation of America, in collaboration with the Celluplastic Corporation, of Newark, N.J., is used by them in the manufacture of non-metallic collapsible tubes for pastes, creams, etc. This new cellulose acetate material is entitled "Lumarith," and is claimed to be tougher, lighter, and more resilient than similar metal tubes.

Geologists in North Carolina, U.S.A., have undertaken a survey to locate deposits of corundum in the state at the request of W.P.B. North Carolina contains the United States' chief deposits of corundum, but owing to large scale importation from abroad and the development of carborundum and other substitutes all the mines have been closed since 1918.

Coal of a higher grade than any yet discovered in Argentina has been located in the Andes foothills in San Juan Province, north of Mendoza. It is stated to be free from sulphur, to possess a satisfactory calorie content, and to be suitable for coking purposes. The main difficulty at present is the distance of the deposit from railroad at Jachal, which lies 60 miles south-west.

In a year end statement the chairman of the International Nickel Co. of Canada, Mr. R. C. Stanley, said that an increase in annual productive capacity of 50,000,000 lb. over that of 1940 was assured. But even this increase was not enough to satisfy the war needs of the United Nations, and must be supplemented by the employment of strict economy, and the fullest possible recovery of nickel-bearing scrap.

A new process for extracting vanadium, claimed to be both economical and rapid and said to assure the United States of an adequate supply, has been announced by the American Chemical Society. It is claimed that the method would speed efficient re-

covery of vanadium, a large supply of which exists in phosphate rock deposits in Idaho. It has been estimated that in the 5700 million tons of phosphate rock in this sector, 500,000 tons are recoverable vanadium.

Forthcoming Events

A meeting of the Leeds Area section of the **Institute of Chemistry**, jointly with the Yorkshire section of the **Society of Chemical Industry**, will be held at 6 p.m., on **January 11**, at the University of Leeds (entrance Woodhouse Lane), when Mr. H. Hollis, B.Sc., A.I.C., will present a paper on "The Functions of a Government Inspection Department in War-Time."

The London section of the **Institution of the Rubber Industry** will meet at 6.30 p.m., on **January 11**, at the Caxton Hall, Westminster, S.W.1, to hear Mr. T. R. Dawson, M.Sc., F.I.C., F.I.R.I., speak on "Organic Loading Fillers which Substitute Rubber."

There will be a joint meeting of the **Chemical Engineering Group** of the Society of Chemical Industry and the **Institution of Chemical Engineers**, at 2.30 p.m., on **January 12**, in the rooms of the Geological Society, Burlington House, Piccadilly, W.1, when a paper on "Solvent Extraction of Lubricating Oils" will be presented by Dr. H. Ter Meulen.

The James Forrest Lecture of the **Institution of Civil Engineers** will take place on **January 12**, at 2 p.m., at the Institution, Great George Street, S.W.1. Sir Charles Darwin, K.B.E., will speak on "The Extreme Properties of Matter."

The Microbiological Panel has arranged a meeting of the Food Group of the **Society of Chemical Industry** and the **Society of Agricultural Bacteriologists**, which will be held at 2 p.m., on **January 13**, at Burlington House, Piccadilly, W.1. Mr. H. F. Clayson will speak on "Links in the Cytase Problem," and Dr. W. J. Dowson on "The Kinds of Bacteria which cause Disease in Plants, and the Types of Disease they Produce." Mr. L. J. Meanwell will speak on a Dairying Subject.

The **Pharmaceutical Society of Great Britain** will meet at 7 p.m. on **January 14**, at 17 Bloomsbury Square, W.C.1, when Mr. E. H. Cotton will speak on "Synthetic Rubbers."

At a meeting of the **Royal Society of Arts**, John Adam Street, Adelphi, W.C.2, to be held at 1.45 p.m., on **January 20**, Professor W. E. S. Turner will speak on "New Uses for Glass."

RYE

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Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

J. R. GIBBS, LTD., Paignton, chemists' agents. (M., 9/1/43.) December 16, £1800 debentures; general charge. *£700, October 18, 1941.

Order Made on Application for Discharge

KOHN, PAVEL, 58 Beech Lane, Earley, near Reading, Berkshire, doctor of chemistry. (O.M.A.D., 9/1/43.) Discharge suspended conditionally for one week, until December 3, 1942.

Company News

Thomas Bolton and Sons, Ltd., announce an interim dividend of $2\frac{1}{2}$ per cent. (same).

Steel Barrel, Scammells, and Associated Engineers, Ltd., announce an interim dividend of 6 per cent. (same).

Sangers, Ltd., announce an interim dividend in respect of the year ending April 30, 1942, of $5\frac{1}{2}$ per cent. (5 per cent.).

Turner and Newall, Ltd., announce a final dividend of $8\frac{1}{2}$ per cent., making $12\frac{1}{2}$ per cent. for the year (same), and a net profit of £580,840 (£506,472).

Chemical and Allied Stocks and Shares

THE trend of the war news and the upward tendency in British Funds continued to assist the general undertone of Stock Exchange markets, and in most sections improvement in the volume of business was reported this week. Where changed, securities of chemical and kindred companies were higher on balance. At the time of writing, Imperial Chemical have risen to 37s. $1\frac{1}{2}$ d., which compares with 36s. 6d. a week ago. Attention has been drawn in the market to the fact that the yield on I.C.I. ordinary is rather higher than the return on various other leading industrial shares, and, as mentioned in these notes, the prevailing view is that the dividend seems likely to be kept on an 8 per cent. basis. Goodlass Wall and Lead Industries 10s. ordinary were also better, having risen from 12s. 6d. to around 13s., while elsewhere, Borax Consolidated deferred rallied to

34s. 6d. aided by the assumption that the dividend is likely to be maintained. Fisons ordinary shares were also assisted by annual report anticipations; business up to 42s. has been recorded at the time of writing.

B. Laporte were again quoted at 71s. 3d. "middle," and W. J. Bush at 50s., but the shares remained very firmly held, and consequently, as in numerous other directions, it is doubtful if quotations have been adequately tested by dealings. Turner & Newall were slightly lower on balance at 72s. 6d., but tended to improve following publication of the full results and annual statement; the chairman states that during the current year it is anticipated that demand for the company's various products is likely to be fully maintained, with the exception of the building materials range. Elsewhere, British Drug Houses changed hands around 23s. 6d. Among shares of companies connected with plastics Thomas De La Rue rose further from 87s. to 88s. 9d., while British Industrial Plastics 2s. ordinary were again around 5s., Erinoid around 10s., and Lacerinoid Products 4s. 3d. Catalin ordinary shares transferred around 3s. 3d. Elsewhere, British Glues & Chemicals 4s. ordinary were firmly held at 7s. 6d.; the preference shares were quoted at 30s. Cellon 5s. ordinary were again 17s. 6d., while International Paint rallied from 103s. 9d. to 105s., and higher prices ruled for Pinchin Johnson and the deferred units of Wall Paper Manufacturers.

Compared with a week ago, British Oxygen were 6d. better at 71s. 6d., and British Aluminium have been well maintained on balance at 49s. 4 $\frac{1}{2}$ d. At 33s. 9d. Lever & Unilever had a firm appearance, and in other directions, British Plaster Board were steady at 27s. 6d. Associated Cement improved 7 $\frac{1}{2}$ d. to 55s. 7 $\frac{1}{2}$ d. The units of the Distillers Co. remained in favour and rose further from 84s. 6d. to 86s. At 36s. 9d. British Match were 3d. better, and among other securities, Cerebos rose 3s. 9d. to £9 $\frac{1}{2}$, while Murex were very firm at 105s. Awaiting the dividend announcement, Nairn & Greenwich have remained at 55s. at the time of writing. Barry & Staines showed a strong recovery, being 37s., compared with 35s. 6d. a week ago. Business around 6s. 3d. has been recorded in Greff-Chemicals 5s. ordinary. Monsanto Chemicals $5\frac{1}{2}$ per cent. preference were again quoted at 22s. 6d. British Tar Products 5s. shares transferred at 9s. $1\frac{1}{2}$ d., British Emulsifiers 2s. ordinary around 3s., and British Lead Mills 2s. ordinary around 3s. 6d. Johnson Matthey 5 per cent. preference transferred at 22s. 10 $\frac{1}{2}$ d. at one time. Among other securities, Tube Investments were firm at 91s., while Allied Ironfounders have moved higher to 41s. 9d. Stewarts & Lloyds were 51s. 3d. Richard Thomas 6 $\frac{1}{2}$ s. 8d. ordinary showed firmness at 8s. 10 $\frac{1}{2}$ d. There were

few movements in textile issues, but Courtaulds were 45s. 6d., and British Celanese rose to 17s. 6d., the latter being responsive to current market hopes as to future dividend prospects. Boots Drug were 38s. 3d., and Sangers were better at 19s. 10½d. In sympathy with the prevailing trend on the Stock Exchange, "Shell" and other leading oil shares were higher on balance.

British Chemical Prices

Market Reports

QUIET conditions prevail in most sections of the industrial chemicals market with the price position showing little, if any, alteration. In regard to contract deliveries the movement is steady and in the aggregate fairly substantial. In the soda products section there is a good call for bicarbonate of soda and soda ash, while supplies of chlorate of soda and bichromate of soda are fully absorbed. Nitrate of soda and hyposulphite soda are firm. Among the potash compounds, yellow prussiate of potash continues to show a rising tendency, while ready outlets are reported for bichromate of potash and caustic potash. The lead oxides are receiving a steady inquiry and zinc oxide is a good market. No change is reported from the acid section, and formaldehyde continues to enjoy a good inquiry. There are

no special features to record from the coal tar products market, conditions in nearly all sections being much the same as during previous weeks. A good demand is maintained for carbolic acid, and cresylic acid is a good market.

MANCHESTER.—Business in most descriptions of chemicals on the Manchester market during the past week has been about back to its pre-holiday level, a moderate volume of new business having found its way on to order-books. For the most part sellers already have plenty of orders on their books and these are being drawn against steadily, especially in the alkalis. Chemicals for the cotton and woollen and allied industries are, on the whole, being taken up in fairly satisfactory quantities. Most of the leading tar products, both light and heavy, are meeting with a steady demand, chiefly against contracts.

GLASGOW.—Business in the Scottish heavy chemical trade has been rather quieter during the past week for home business. Export trade still remains very limited. Prices keep very firm with a tendency to rise.

Price Changes

Lactic Acid.—Pale tech., 48½ per cent. by weight, £49 per ton; dark tech., 43½ per cent. by weight, £42 per ton ex works; barrels returnable carriage paid.

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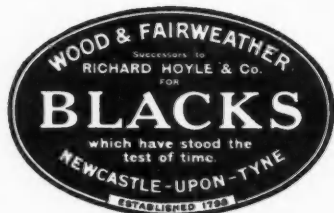


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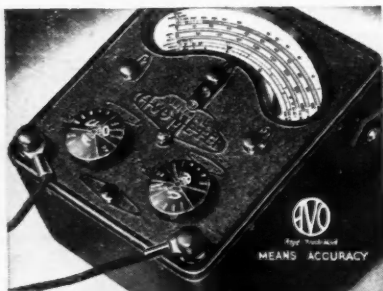
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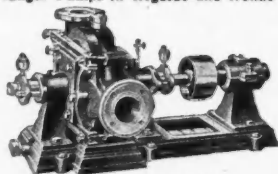
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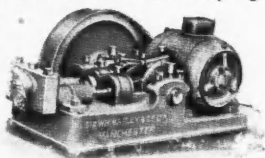
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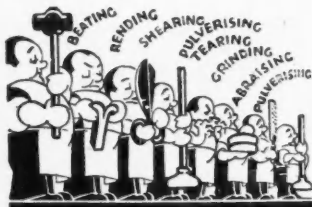
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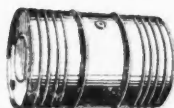
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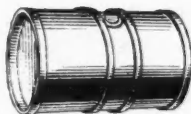
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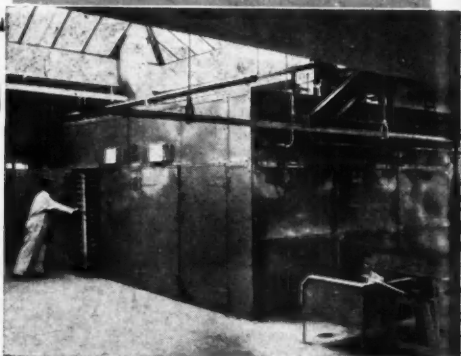
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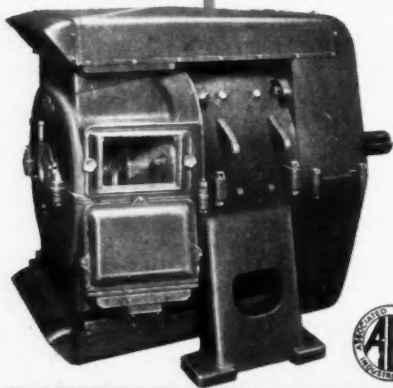


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